D-Link®
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xSTACK

Manual

Product Model: xStack® DGS-3200 Series

Layer 2 Managed Gigabit Ethernet Switch

Release 1.35

IPv6 READY

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Table of Contents

Intended Readers ix
Typographical Conventions ix
Notes, Notices, and Cautions x
Safety Cautions x
General Precautions for Rack-Mountable Products xi
Lithium Battery Precaution xiii
Protecting Against Electrostatic Discharge xiii
Web-based Switch Configuration 1
Introduction 1
Logging onto the Web Manager 1
Web-based User Interface 2
Areas of the User Interface 2
Web Pages 3
Configuration 4
Device Information 4
System Information 5
Serial Port Settings 6
IP Address 6
Setting the Switch's IP Address using the Console Interface 8
IPv6 Interface Settings 8
IPv6 Route Table 9
IPv6 Neighbor Settings 10
Port Configuration 11
Port Settings 11
Port Description 12
Port Error Disabled 12
Static ARP Settings 13
User Accounts 14
Admin and User Privileges 14
System Log Configuration 15
System Log Settings 15
System Log Host 16
System Severity Settings 16
DHCP/BOOTP Relay 17
DHCP/BOOTP Relay Global Settings 17
DHCP/BOOTP Relay Interface Settings 20
DHCP Local Relay Settings 20
DHCP Auto Configuration Settings 21
MAC Address Aging Time 22
Web Settings 22

Telnet Settings 23
Password Encryption 23
CLI Paging Settings 24
Firmware Information 24
Power Saving Settings 25
Dual Configuration Settings 26
SMTP Settings 27
Ping Test 28
SNTP Settings 29
Time Settings 29
TimeZone Settings 30
MAC Notification Settings 31
MAC Notification Global Settings 31
MAC Notification Port Settings 32
SNMP Settings 33
SNMP Global State Settings 34
SNMP View Table 34
SNMP Group Table 35
SNMP User Table 36
SNMP Community Table 37
SNMP Host Table 38
SNMP v6Host Table 39
SNMP Engine ID 40
SNMP Trap Configuration 40
RMON 40
Single IP Management 41
Single IP Settings 43
Topology 44
Firmware Upgrade 51
Configuration File Backup/Restore 51
Upload Log File 51
Layer 2 Features 52
Jumbo Frame 52
Egress Filter Settings 53
802.1Q VLAN 53
802.1v Protocol VLAN 62
802.1v Protocol Group Settings 62
802.1v Protocol VLAN Settings 62
MAC Based VLAN Settings 64
GVRP Settings 64
PVID Auto Assign Settings 65
Trunking 66
VLAN Trunk Settings 68
LACP Port Settings 69

Traffic Segmentation 70
IGMP Snooping 70
IGMP Snooping Settings 70
Data Driven Learning Settings 71
ISM VLAN Settings 72
Restrictions and Provisos 72
ISM Profile Settings 73
IP Multicast Profile Settings 73
Limited Multicast Address Range Settings 74
Max Multicast Group Settings 75
MLD Snooping Settings 75
Port Mirroring 77
Loopback Detection Settings 78
Spanning Tree 79
STP Bridge Global Settings 81
STP Port Settings 82
MST Configuration Identification 84
STP Instance Settings 85
MSTP Port Information 86
Forwarding & Filtering 87
Unicast Forwarding 87
Multicast Forwarding 87
Multicast Filtering Mode 88
QoS 89
Bandwidth Control 91
Traffic Control 92
802.1p Default Priority 94
802.1p User Priority 94
QoS Scheduling Mechanism 95
Security 96
Safeguard Engine 96
Trusted Host 98
IP-MAC-Port Binding 99
IMP Global Settings 99
IMP Port Settings 99
IMP Entry Settings 101
DHCP Snooping Entries 101
MAC Block List 102
Port Security 103
Port Security Settings 103
Port Lock Entries 104
DHCP Server Screening 105
DHCP Screening Port Settings 105
DHCP Offer Filtering 105

Guest VLAN 107
802.1X (Port-Based and Host-Based Access Control) 108
Authentication Server 109
Authenticator 109
Client 110
Authentication Process 110
Understanding 802.1X Port-based and Host-based Network Access Control 111
802.1X Settings 112
802.1X User 114
Initialize Port(s) 115
Reauthenticate Port(s) 116
Authentic RADIUS Server 117
SSL Settings 118
SSH 120
SSH Configuration 120
SSH Authmode and Algorithm Settings 121
SSH User Authentication Mode 123
Access Authentication Control 124
Authentication Policy and Parameter Settings 125
Application Authentication Settings 125
Authentication Server Group 126
Authentication Server Host 127
Login Method Lists 129
Enable Method Lists 130
Configure Local Enable Password 131
Enable Admin 131
MAC-based Access Control 132
MAC-based Access Control Settings 132
MAC-based Access Control Local Settings 134
Web-based Access Control (WAC) 134
WAC Global Settings 136
WAC User Settings 137
WAC Port Settings 138
JWAC 139
JWAC Global Settings 139
JWAC Port Settings 141
JWAC User Settings 142
JWAC Customize Page Language 142
JWAC Customize Page 143
Multiple Authentication 143
Authorization Network State Settings 146
Multiple Authentication Settings 146
Guest VLAN 147
IGMP Access Control Settings (IGMP Authentication) 148
ACL 149

Access Profile List 149
CPU Access Profile List 163
Time Range Settings 176
Monitoring 177
Device Environment 177
Cable Diagnostic 178
CPU Utilization 178
Port Utilization 180
Packet Size 181
Packets 183
Received (RX) 183
UMB_cast (RX) 185
Transmitted (TX) 186
Errors 188
Received (RX) 188
Transmitted (TX) 190
Port Access Control 192
Authenticator State 192
Authenticator Statistics 194
Authenticator Session Statistics 196
Authenticator Diagnostics 198
RADIUS Authentication 200
RADIUS Account Client 201
Browse ARP Table 203
Browse VLAN 203
Browse Router Port 204
Browse MLD Router Port 204
Browse Session Table 205
IGMP Snooping Group 205
MLD Snooping Group 206
WAC Authenticating State 207
JWAC Host Table 208
MAC Address Table 209
System Log 210
MAC-based Access Control Authentication State 211
Save Services and Tools 212
Save Configuration ID 1 212
Save Configuration ID 2 213
Save Log 213
Save All 213
Configuration File Backup & Restore 214
Upload Log File 214
Reset 214

Download Firmware 215
Reboot System 215
Appendix A – Mitigating ARP Spoofing Attacks Using Packet Content ACL 216
Appendix B – Switch Log Entries 223
Appendix C – Trap Logs 234
Appendix D – Password Recovery Procedure 237
Appendix E – Glossary 238
Warranty & Support 240

Intended Readers

The ***DGS-3200 Series Manual*** contains information for setup and management of the Switch. This manual is intended for network managers familiar with network management concepts and terminology.

Typographical Conventions

Convention	Description
[ ]	In a command line, square brackets indicate an optional entry. For example: [copy filename] means that optionally you can type copy followed by the name of the file. Do not type the brackets.
Bold font	Indicates a button, a toolbar icon, menu, or menu item. For example: Open the **File** menu and choose **Cancel**. Used for emphasis. May also indicate system messages or prompts appearing on screen. For example: **You have mail**. **Bold** font is also used to represent filenames, program names and commands. For example: **use the copy command.**
`Boldface Typewriter Font`	Indicates commands and responses to prompts that must be typed exactly as printed in the manual.
Initial capital letter	Indicates a window name. Names of keys on the keyboard have initial capitals. For example: Click Enter.
Italics	Indicates a window name or a field. Also can indicate a variables or parameter that is replaced with an appropriate word or string. For example: type *filename* means that the actual filename should be typed instead of the word shown in italic.
Menu Name > Menu Option	**Menu Name > Menu Option** Indicates the menu structure. **Device > Port > Port Properties** means the Port Properties menu option under the Port menu option that is located under the Device menu.

Notes, Notices, and Cautions

A **NOTE** indicates important information that helps make better use of the device.

A **NOTICE** indicates either potential damage to hardware or loss of data and tells how to avoid the problem.

A **CAUTION** indicates a potential for property damage, personal injury, or death.

Safety Cautions

Use the following safety guidelines to ensure your own personal safety and to help protect your system from potential damage. Throughout this safety section, the caution icon ( ) is used to indicate cautions and precautions that need to be reviewed and followed.

To reduce the risk of bodily injury, electrical shock, fire, and damage to the equipment, observe the following precautions.

- Observe and follow service markings.
  - Do not service any product except as explained in the system documentation.
  - Opening or removing covers that are marked with the triangular symbol with a lightning bolt may expose the user to electrical shock.
  - Only a trained service technician should service components inside these compartments.
- If any of the following conditions occur, unplug the product from the electrical outlet and replace the part or contact your trained service provider:
  - Damage to the power cable, extension cable, or plug.
  - An object has fallen into the product.
  - The product has been exposed to water.
  - The product has been dropped or damaged.
  - The product does not operate correctly when the operating instructions are correctly followed.
- Keep your system away from radiators and heat sources. Also, do not block cooling vents.
- Do not spill food or liquids on system components, and never operate the product in a wet environment. If the system gets wet, see the appropriate section in the troubleshooting guide or contact your trained service provider.

- Do not push any objects into the openings of the system. Doing so can cause fire or electric shock by shorting out interior components.
- Use the product only with approved equipment.
- Allow the product to cool before removing covers or touching internal components.
- Operate the product only from the type of external power source indicated on the electrical ratings label. If unsure of the type of power source required, consult your service provider or local power company.
- To help avoid damaging the system, be sure the voltage selection switch (if provided) on the power supply is set to match the power available at the Switch's location:
  - 115 volts (V)/60 hertz (Hz) in most of North and South America and some Far Eastern countries such as South Korea and Taiwan
  - 100 V/50 Hz in eastern Japan and 100 V/60 Hz in western Japan
  - 230 V/50 Hz in most of Europe, the Middle East, and the Far East
- Also, be sure that attached devices are electrically rated to operate with the power available in your location.
- Use only approved power cable(s). If you have not been provided with a power cable for your system or for any AC-powered option intended for your system, purchase a power cable that is approved for use in your country. The power cable must be rated for the product and for the voltage and current marked on the product's electrical ratings label. The voltage and current rating of the cable should be greater than the ratings marked on the product.
- To help prevent electric shock, plug the system and peripheral power cables into properly grounded electrical outlets. These cables are equipped with three-prong plugs to help ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a cable. If using an extension cable is necessary, use a 3-wire cable with properly grounded plugs.
- Observe extension cable and power strip ratings. Make sure that the total ampere rating of all products plugged into the extension cable or power strip does not exceed 80 percent of the ampere ratings limit for the extension cable or power strip.
- To help protect the system from sudden, transient increases and decreases in electrical power, use a surge suppressor, line conditioner, or uninterruptible power supply (UPS).
- Position system cables and power cables carefully; route cables so that they cannot be stepped on or tripped over. Be sure that nothing rests on any cables.
- Do not modify power cables or plugs. Consult a licensed electrician or your power company for site modifications. Always follow your local/national wiring rules.
- When connecting or disconnecting power to hot-pluggable power supplies, if offered with your system, observe the following guidelines:
  - Install the power supply before connecting the power cable to the power supply.
  - Unplug the power cable before removing the power supply.
  - If the system has multiple sources of power, disconnect power from the system by unplugging all power cables from the power supplies.
- Move products with care; ensure that all casters and/or stabilizers are firmly connected to the system. Avoid sudden stops and uneven surfaces.

General Precautions for Rack-Mountable Products

Observe the following precautions for rack stability and safety. Also, refer to the rack installation documentation accompanying the system and the rack for specific caution statements and procedures.

- Systems are considered to be components in a rack. Thus, "component" refers to any system as well as to various peripherals or supporting hardware.

CAUTION: Installing systems in a rack without the front and side stabilizers installed could cause the rack to tip over, potentially resulting in bodily injury under certain circumstances. Therefore, always install the stabilizers before installing components in the rack. After installing system/components in a rack, never pull more than one component out of the rack on its slide assemblies at one time. The weight of more than one extended component could cause the rack to tip over and may result in serious injury.

- Before working on the rack, make sure that the stabilizers are secured to the rack, extended to the floor, and that the full weight of the rack rests on the floor. Install front and side stabilizers on a single rack or front stabilizers for joined multiple racks before working on the rack.
- Always load the rack from the bottom up, and load the heaviest item in the rack first.
- Make sure that the rack is level and stable before extending a component from the rack.
- Use caution when pressing the component rail release latches and sliding a component into or out of a rack; the slide rails can pinch your fingers.
- After a component is inserted into the rack, carefully extend the rail into a locking position, and then slide the component into the rack.
- Do not overload the AC supply branch circuit that provides power to the rack. The total rack load should not exceed 80 percent of the branch circuit rating.
- Ensure that proper airflow is provided to components in the rack.
- Do not step on or stand on any component when servicing other components in a rack.

NOTE: A qualified electrician must perform all connections to DC power and to safety grounds. All electrical wiring must comply with applicable local or national codes and practices.

CAUTION: Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if uncertain that suitable grounding is available.

CAUTION: The system chassis must be positively grounded to the rack cabinet frame. Do not attempt to connect power to the system until grounding cables are connected. Completed power and safety ground wiring must be inspected by a qualified electrical inspector. An energy hazard will exist if the safety ground cable is omitted or disconnected.

CAUTION: When mounting the Switch on a cement wall, a proper concrete sleeve anchor should be used, such as the one that is included in the optional D-Link Wall Mount kit (DRE-KIT018).

Lithium Battery Precaution

CAUTION: Incorrectly replacing the lithium battery of the Switch may cause the battery to explode. Replace this battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Protecting Against Electrostatic Discharge

Static electricity can harm delicate components inside the system. To prevent static damage, discharge static electricity from your body before touching any of the electronic components, such as the microprocessor. This can be done by periodically touching an unpainted metal surface on the chassis.

The following steps can also be taken prevent damage from electrostatic discharge (ESD):

1. When unpacking a static-sensitive component from its shipping carton, do not remove the component from the antistatic packing material until ready to install the component in the system. Just before unwrapping the antistatic packaging, be sure to discharge static electricity from your body.
2. When transporting a sensitive component, first place it in an antistatic container or packaging.
3. Handle all sensitive components in a static-safe area. If possible, use antistatic floor pads, workbench pads and an antistatic grounding strap.

Section 1

Web-based Switch Configuration

Introduction

Logging onto the Web Manager

Web-Based User Interface

Introduction

All software functions of the Switch can be managed, configured, and monitored via the embedded web-based (HTML) interface. Manage the Switch from remote stations anywhere on the network through a standard browser, such as Internet Explorer 5.5 or later, Netscape 8.0 or later, or Firefox 2.0 or later. The browser acts as a universal access tool and can communicate directly with the Switch using the HTTP protocol.

The Web-based management module and the Console program (and Telnet) are different ways to access the same internal switching software and configure it. Thus, all settings encountered in web-based management are the same as those found in the console program.

Logging onto the Web Manager

To begin managing the Switch, simply run the browser installed on your computer and point it to the IP address you have defined for the device. The URL in the address bar should read something like: http://123.123.123.123, where the numbers 123 represent the IP address of the Switch.

NOTE: The factory default IP address is 10.90.90.90.

This opens the management module's user authentication window, as seen below.

Figure 1- 1. Enter Network Password window

Enter “admin” in both the User Name field and the Password field and click **OK**. This will open the Web-based user interface. The Switch management features available in the web-based manager are explained below.

Web-based User Interface

The user interface provides access to various Switch configuration and management windows, allows the user to view performance statistics, and permits graphical monitoring of the system status.

Areas of the User Interface

The figure below shows the user interface. Three distinct areas divide the user interface, as described in the table.

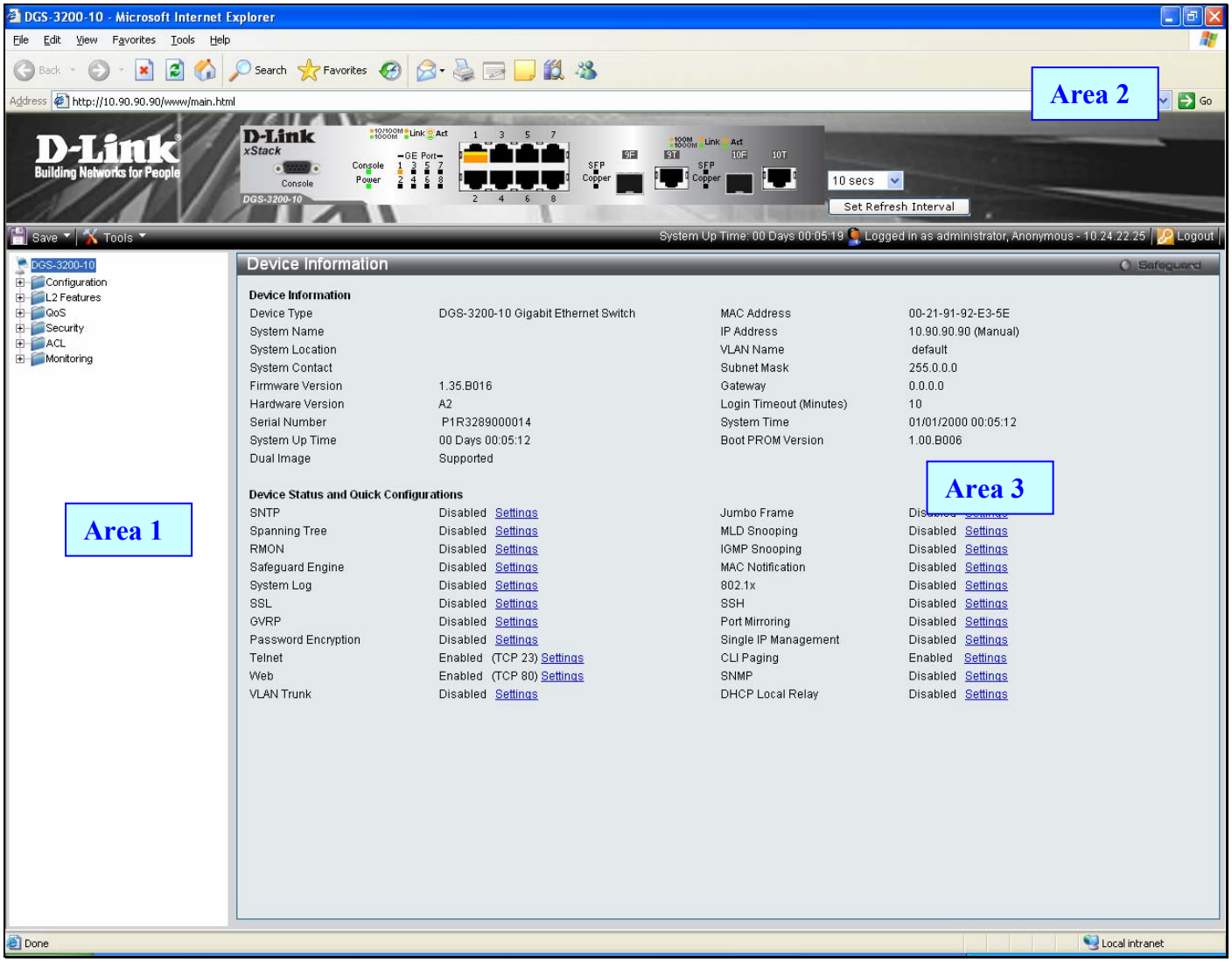


Figure 1- 2. Main Web-Manager window

Area	Function
Area 1	Select the folder or window to display. Open folders and click the hyperlinked window buttons and subfolders contained within them to display windows.
Area 2	Presents a graphical near real-time image of the front panel of the Switch. This area displays the Switch's ports and expansion modules and shows port activity, depending on the specified mode. Some management functions, including port monitoring are accessible here. Click the D-Link logo to go to the D-Link website.
Area 3	Presents Switch status based on user selection and the entry of configuration data. In addition, hyperlinks are offered for many Switch features to enable quick configuration.

Web Pages

When connecting to the management mode of the Switch with a web browser, a login screen is displayed. Enter a user name and password to access the Switch's management mode.

Below is a list of the folders and windows available in the web interface:

Configuration – Contains the following main folders, windows, and related windows: System Information, Serial Port Settings, IP Address, IPv6 Interface Settings, IPv6 Route Table, IPv6 Neighbor Settings, Port Configuration, Port Settings, Port Description, Port Error Disabled, Static ARP Settings, User Accounts, System Log Configuration, System Log Settings, System Log Host, System Severity Settings, DHCP/BOOTP Relay, DHCP/BOOTP Relay Global Settings, DHCP/BOOTP Relay Interface Settings, DHCP Local Relay Settings, DHCP Auto Configuration Settings, MAC Address Aging Time, Web Settings, Telnet Settings, Password Encryption, CLIpaging Settings, Firmware Information, Power Saving Settings, Dual Configuration Settings, SMTP Settings, Ping Test, SNTP Settings, Time Settings, TimeZone Settings, MAC Notification Settings, MAC Notification Global Settings, MAC Notification Port Settings, SNMP Settings, SNMP Global Settings, SNMP View Table, SNMP Group Table, SNMP User Table, SNMP Community Table, SNMP Host Table, SNMP v6Host Table, SNMP Engine ID, SNMP Trap Configuration, RMON, Single IP Management, Single IP Settings, Topology, Firmware Upgrade, Configuration File Backup/Restore, and Upload Log File.

L2 Features – Contains the following main folders, windows, and related windows: Jumbo Frame, Egress Filter Settings, 802.1Q VLAN, 802.1Q Protocol VLAN, Protocol VLAN Group Settings, Protocol VLAN Port Settings, MAC Based VLAN Settings, GVRP Settings, PVID Auto Assign Settings, Trunking, LACP Port Settings, Traffic Segmentation, IGMP Snooping, IGMP Snooping Settings, Data Driven Learning Settings, ISM VLAN Settings, IP Multicast Profile Settings, Limited Multicast Address Range Settings, Max Multicast Group Settings, MLD Snooping Settings, Port Mirroring, Loopback Detection Settings, Spanning Tree, STP Bridge Global Settings, STP Port Settings, MST Configuration Identification, STP Instance Settings, MSTP Port Information, Forwarding & Filtering, Unicast Forwarding, Multicast Forwarding, and Multicast Filtering Mode.

QoS – Contains the following main folders, windows, and related windows: Bandwidth Control, Traffic Control, 802.1p Default Priority, 802.1p User Priority, and QoS Scheduling Mechanism.

Security – Contains the following main folders, windows, and related windows: Safeguard Engine, Trusted Host, IP-MAC-Port Binding, IMP Global Settings, IMP Port Settings, IMP Entry Settings, DHCP Snooping Entries, MAC Block List, Port Security, Port Security Settings, Port Lock Entries, DHCP Server Screening, DHCP Screening Port Settings, DHCP Offer Filtering, Guest VLAN, 802.1X, 802.1X Settings, 802.1X User, Initialize Port(s), Reauthenticate Port(s), Authentic RADIUS Server, SSL Settings, SSH, SSH Configuration, SSH Authmode and Algorithm Settings, SSH User Authentication Mode, Access Authentication Control, Authentication Policy and Parameter Settings, Application Authentication Settings, Authentication Server Group, Authentication Server Host, Login Method Lists, Enable Method Lists, Configure Local Enable Password, Enable Admin, MAC Based Access Control, MAC Based Access Control Global Settings, MAC-based Access Control Local Settings, Web Authentication, Web Global Settings, Web User Settings, Web Port Settings, JWAC, JWAC Global Settings, JWAC Port Settings, JWAC User Settings, JWAC Customize Page Language, JWAC Customize Page, Multiple Authentication, Authorization Network State Settings, Multiple Authentication Settings, Guest VLAN, and IGMP Access Control Settings.

ACL – Contains the following main folders, windows, and related windows: Access Profile List, CPU Access Profile List, and Time Range Settings.

Monitoring – Contains the following main folders, windows, and related windows: Device Environment, Cable Diagnostic, CPU Utilization, Port Utilization, Packet Size, Packets, Received (RX), UMB_cast (RX), Transmitted (TX), Errors, Received (RX), Transmitted (TX), Port Access Control, RADIUS Authentication, RADIUS Account Client, Authenticator State, Authenticator Statistics, Authenticator Session Statistics, Authenticator Diagnostics, Browse ARP Table, Browse VLAN, Browse Router Port, Browse MLD Router Port, Browse Session Table, IGMP Snooping Group, MLD Snooping Group, WAC Authenticating State, JWAC Host Table, MAC Address Table, System Log, and MAC-based Access Control Authentication State.

Save – Contains links for Save Configuration ID 1, Save Configuration ID 2, Save Log, and Save All.

Tools – Contains the following windows: Configuration File Backup & Restore, Upload Log File, Reset, Download Firmware, and Reboot System.

NOTE: Be sure to configure the user name and password in the **User Accounts** window before connecting the Switch to the greater network.

Section 2

Configuration

Device Information
System Information
Serial Port Settings
IP Address
IPv6 Interface Settings
IPv6 Route Table
IPv6 Neighbor Settings
Port Configuration
Static ARP Settings
User Accounts
System Log Configuration
System Severity Settings
DHCP/BOOTP Relay
DHCP Local Relay Settings
DHCP Auto Configuration Settings
MAC Address Aging Time
Web Settings
Telnet Settings
Password Encryption
CLI Paging Settings
Firmware Information
Power Saving Settings
Dual Configuration Settings
SMTP Settings
Ping Test
SNTP Settings
MAC Notification Settings
SNMP Settings
Single IP Management

Device Information

This window contains the main settings for all major functions for the Switch. It appears automatically when you log on to the Switch. To return to the **Device Information** window after viewing other windows, click the **DGS-3200-10/DGS-3200-16** folder. The **Device Information** window shows the Switch's MAC Address (assigned by the factory and unchangeable), the Boot PROM Version, Firmware Version, Hardware Version, and many other important types of information. This is helpful to keep track of PROM and firmware updates and to obtain the Switch's MAC address for entry into another network device's address table, if necessary. In addition, this window displays the status of functions on the Switch to quickly assess their current global status. Many functions are hyper-linked for easy access to enable quick configuration from this window.

Figure 2- 1. Device Information window

System Information

The user can enter a System Name, System Location, and System Contact to aid in defining the Switch.

To view the following window, click **Configuration** > **System Information**:

Figure 2- 2. System Information window

The fields that can be configured are described below:

Parameter	Description
System Name	Enter a system name for the Switch, if so desired. This name will identify it in the Switch network.
System Location	Enter the location of the Switch, if so desired.
System Contact	Enter a contact name for the Switch, if so desired.

Click **Apply** to implement changes made.

Serial Port Settings

The user can adjust the Baud Rate and the Auto Logout values.

To view the following window, click **Configuration** > **Serial Port Settings**:

Figure 2- 3. Serial Port Settings window

Baud Rate	This field specifies the baud rate for the serial port on the Switch. There are four possible baud rates to choose from, *9600*, *19200*, *38400* and *115200.* For a connection to the Switch using the CLI interface, the baud rate must be set to *115200*, which is the default setting.
Auto Logout	Select the logout time used for the console interface. This automatically logs the user out after an idle period of time, as defined. Choose from the following options: *2 mins, 5 mins, 10 mins, 15 mins* or *Never*. The default setting is *10 mins*.

Click **Apply** to implement changes made.

IP Address

The IP address may initially be set using the console interface prior to connecting to it through the Ethernet. If the Switch IP address has not yet been changed, read the introduction of the *DGS-3200 Series CLI Manual* for more information. TheWeb manager will display the Switch's current IP settings.

To view the following window, click **Configuration** > **IP Address**:

Figure 2- 4. IP Address window

To manually assign the Switch's IP address, subnet mask, and default gateway address:

1. Click the Manual radio button at the top of the window.
2. Enter the appropriate IP Address and Subnet Mask.
3. If accessing the Switch from a different subnet from the one it is installed on, enter the IP address of the default Gateway. If managing the Switch from the subnet on which it is installed, the user may leave the default address (0.0.0.0) in this field.
4. If the Switch has no previously configured VLANs, the user can use the Management VLAN Name entitled "default". This default Management VLAN contains all of the Switch ports as members. If the Switch has previously configured VLANs, the user will need to enter the VLAN ID of the VLAN that contains the port connected to the management station that will access the Switch. The Switch will allow management access from stations with the same VID listed here.

NOTE: The Switch's factory default IP address is 10.90.90.90 with a subnet mask of 255.0.0.0 and a default gateway of 0.0.0.0.

To use the DHCP or BOOTP protocols to assign the Switch an IP address, subnet mask, and default gateway address:

Use the radio button at the top of the window to choose either DHCP or BOOTP. This selects the method the Switch assigns an IP address on the next reboot.

The following parameters may be configured or viewed:

Parameter	Description
Manual	Allows the entry of an IP address, subnet mask, and a default gateway for the Switch. These fields should be of the form xxx.xxx.xxx.xxx, where each xxx is a number (represented in decimal form) between *0* and *255*. This address should be a unique address on the network assigned for use by the network administrator.
DHCP	The Switch will send out a DHCP broadcast request when it is powered up. The DHCP protocol allows IP addresses, network masks, and default gateways to be assigned by a DHCP server. If this option is set, the Switch will first look for a DHCP server to provide it with this information before using the default or previously entered settings.
BOOTP	The Switch will send out a BOOTP broadcast request when it is powered up. The BOOTP protocol allows IP addresses, network masks, and default gateways to be assigned by a central BOOTP server. If this option is set, the Switch will first look for a BOOTP server to provide it with this information before using the default or previously entered settings.
Subnet Mask	A Bitmask that determines the extent of the subnet that the Switch is on. Should be of the form xxx.xxx.xxx.xxx, where each xxx is a number (represented in decimal) between *0* and *255*. The value should be 255.0.0.0 for a Class A network, 255.255.0.0 for a Class B network, and 255.255.255.0 for a Class C network, but custom subnet masks are allowed.
Gateway	IP address that determines where packets with a destination address outside the current subnet should be sent. This is usually the address of a router or a host acting as an IP gateway. If your network is not part of an intranet, or you do not want the Switch to be accessible outside your local network, you can leave this field unchanged.
Management VLAN Name	This allows the entry of a VLAN name from which a management station will be allowed to manage the Switch using TCP/IP (in-band via Web manager or Telnet). Management stations that are on VLANs other than the one entered here will not be able to manage the Switch in-band unless their IP addresses are entered in the **Trusted Host** window (**Security > Trusted Host)**. If VLANs have not yet been configured for the Switch, the default VLAN contains all of the Switch's ports. There are no entries in the Trusted Host table, by default, so any management station that can connect to the Switch can access the Switch until a management VLAN is specified or Management Station IP addresses are assigned.

Click **Apply** to implement changes made.

Setting the Switch's IP Address using the Console Interface

Each Switch must be assigned its own IP Address, which is used for communication with an SNMP network manager or other TCP/IP application (for example BOOTP, TFTP). The Switch's default IP address is 10.90.90.90. The default Switch IP address can be changed to meet the specification of your networking address scheme.

The IP address for the Switch must be set before the Web-based manager can manage the switch. The Switch IP address can be automatically set using BOOTP or DHCP protocols, in which case the actual address assigned to the Switch must be known. The IP address may be set using the Command Line Interface (CLI) over the console serial port as follows:

- Starting at the command line prompt, enter the commands **config ipif System ipaddress xxx.xxx.xxx.xxx/ yyy.yyy.yyy.yyy.** Where the x's represent the IP address to be assigned to the IP interface named System and the y's represent the corresponding subnet mask.
- Alternatively, the user can enter **config ipif System ipaddress xxx.xxx.xxx.xxx/z.** Where the x's represent the IP address to be assigned to the IP interface named **System** and the z represents the corresponding number of subnets in CIDR notation.

The IP interface named System on the Switch can be assigned an IP address and subnet mask, which can then be used to connect a management station to the Switch's Telnet or Web-based management agent.

Successful entry of the command will produce a "**Success"** message**,** indicating that the command execution was correctly. The user may now utilize this address to configure or manage the Switch through Telnet, the Command Line Interface (CLI) or the Web-based management (GUI).

IPv6 Interface Settings

Users can display the Switch's current IPv6 interface settings.

To view the following window, click **Configuration** > **IPv6 Interfaces Settings**:

Figure 2- 5. IPv6 Interface Settings window

To configure IPv6 interface settings, enter an Interface Name, a VLAN Name, and make sure the Interface Admin. State is *Enabled*. Click the **Create** button. The new entry will appear in the Interface Table at the bottom of the window.

To modify an Interface Table entry, click the corresponding **Edit** button. The following window opens:

Figure 2- 6. IPv6 Interface Settings (Edit) window

After making the desired changes, click the **Apply** button.

The following parameters may be configured or viewed:

Parameter	Description
Interface Name	The name of the IPv6 interface being modified.
VLAN Name	Enter the VLAN name of the IPv6 interface.
IPv6 Address	Enter the IPv6 address of the interface to be modified.
Admin. State	Toggle the state between *Enabled* and *Disabled*.
NS Retransmit Time (0-4294967295)	Enter a value between *0* and *4294967295*. This is the neighbor solicitation's retransmit timer in milliseconds. The default is zero.
Automatic Link Local Address	Toggle between *Enabled* and *Disabled*. Enabling this is helpful when no external source of network addressing information is available.
Default Gateway	Enter the IPv6 address of the default gateway.
Active	This read-only field indicates the status of this entry.

IPv6 Route Table

The user can configure the Switch's IPv6 Route Table.

To view the following window, click **Configuration** > **IPv6 Route Table**:

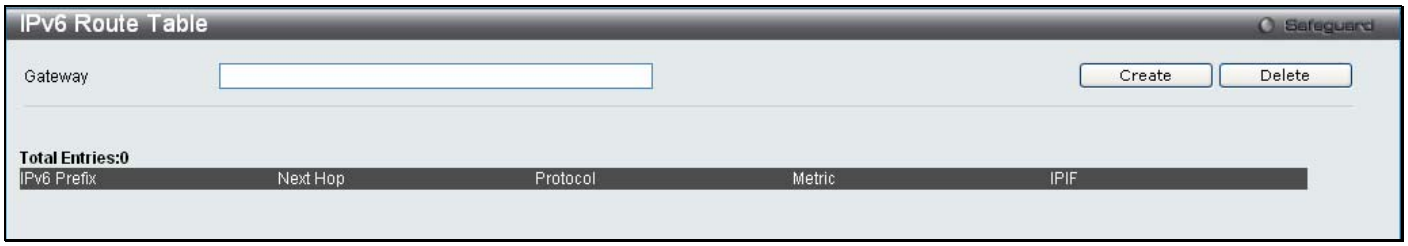


Figure 2- 7. IPv6 Route Table window

Enter an IPv6 address in the Gateway field and click the **Create** button.

IPv6 Neighbor Settings

The user can configure the Switch's IPv6 neighbor settings. The Switch's current IPv6 neighbor settings will be displayed in the table at the bottom of this window.

To view the following window, click **Configuration** > **IPv6 Neighbor Settings**:

Figure 2- 8. IPv6 Neighbor Settings window

Enter the Interface Name, Neighbor IPv6 Address, and the Link Layer MAC Address and then click the **Add** button. The State can be set to *All*, *Address*, *Static*, or *Dynamic*.

To look for an IPv6 Neighbor Settings table entry, enter the Interface Name, select the desired State in the middle section of this window, and then click the **Find** button.

To delete all the entries being displayed on the table at the bottom of this window, click the **Clear** button.

The following parameters may be configured or viewed:

Parameter	Description
Interface Name	Enter the name of the IPv6 neighbor. To search for all the current interfaces on the Switch, go to the second Interface Name field in the middle part of the window, tick the All check box, and then click the **Find** button.
Neighbor IPv6 Address	Enter the neighbor IPv6 address.
Link Layer MAC Address	Enter the link layer MAC address.
State	Use the drop-down menu to select *All*, *Address*, *Static*, or *Dynamic*.

Port Configuration

The **Port Configuration** folder contains three windows: **Port Settings**, **Port Description**, and **Port Error Disabled**.

Port Settings

To view the following window, click **Configuration** > **Port Configuration > Port Settings**:

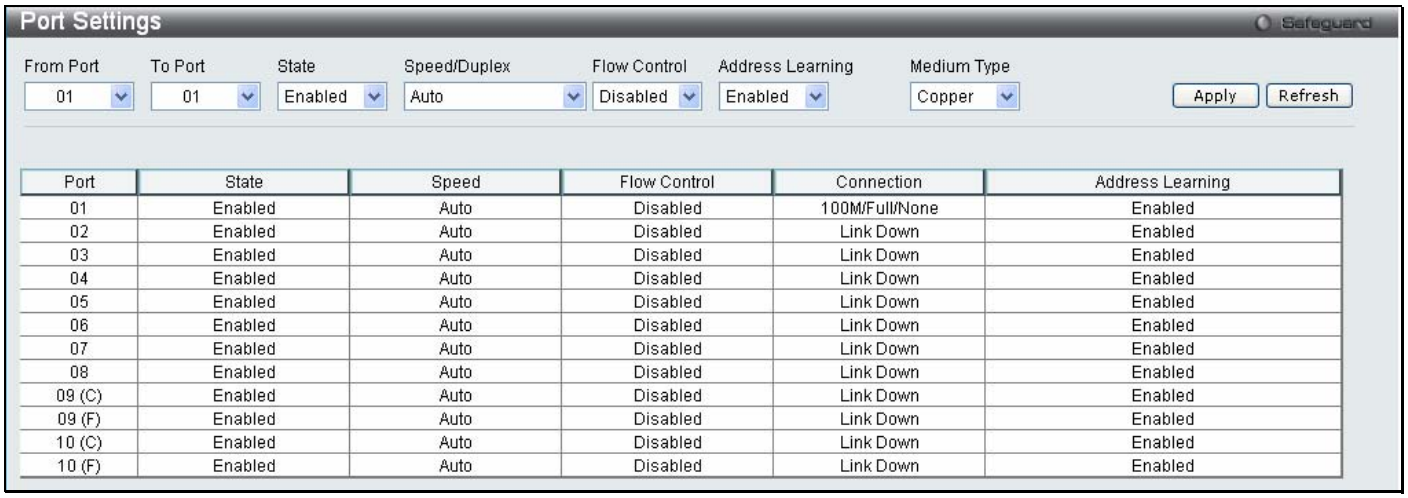


Figure 2- 9. Port Settings window

To configure switch ports:

1. Choose the port or sequential range of ports using the From Port and To Port pull-down menus.
2. Use the remaining pull-down menus to configure the parameters described below:

The following parameters may be configured or viewed:

Parameter	Description
State	Toggle the State field to either enable or disable a given port or group of ports.
Speed/Duplex	Toggle the Speed/Duplex field to either select the speed and duplex/half-duplex state of the port. *Auto* denotes auto-negotiation between 10 and 100 Mbps devices, in full- or half-duplex. The *Auto* setting allows the port to automatically determine the fastest settings the device the port is connected to can handle, and then to use those settings. The other options are *10M Half*, *10M Full, 100M Half*, *100M Full*, *1000M Full_Master*, *1000M Full_Slave, and 1000M Full*. There is no automatic adjustment of port settings with any option other than *Auto*. The Switch allows the user to configure three types of gigabit connections; *1000M Full_Master*, *1000M Full_Slave*, and *1000M Full*. Gigabit connections only support full duplex connections and take on certain characteristics that are different from the other choices listed. The *1000M Full_Master* and *1000M Full_Slave* parameters refer to connections running a 1000BASE-T cable for connection between the Switch port and other device capable of a gigabit connection. The master setting (*1000M Full_Master)* will allow the port to advertise capabilities related to duplex, speed and physical layer type. The master setting will also determine the master and slave relationship between the two connected physical layers. This relationship is necessary for establishing the timing control between the two physical layers. The timing control is set on a master physical layer by a local source. The slave setting (*1000M Full_Slave)* uses loop timing, where the timing comes from a data stream received from the master. If one connection is set for *1000M Full_Master*, the other side of the connection must be set for *1000M Full_Slave*. Any other configuration will result in a link down status for both ports.
Flow Control	Displays the flow control scheme used for the various port configurations. Ports configured for full-duplex use 802.3x flow control, half-duplex ports use backpressure flow con onfi, and Auto ports use an automatic selection of the two. The default is *Disabled*.

Address Learning	Enable or disable MAC address learning for the selected ports. When *Enabled*, destination and source MAC addresses are automatically listed in the forwarding table. When address learning is *Disabled*, MAC addresses must be manually entered into the forwarding table. This is sometimes done for reasons of security or efficiency. See the section on Forwarding/Filtering for information on entering MAC addresses into the forwarding table. The default setting is *Enabled*.
Medium Type	If configuring the Combo ports, this defines the type of transport medium to be used, whether *Copper* or *Fiber*.

Click **Apply** to implement the new settings on the Switch.

Port Description

The Switch supports a port description feature where the user may name various ports.

To view the following window, click **Configuration** > **Port Configuration** > **Port Description**:

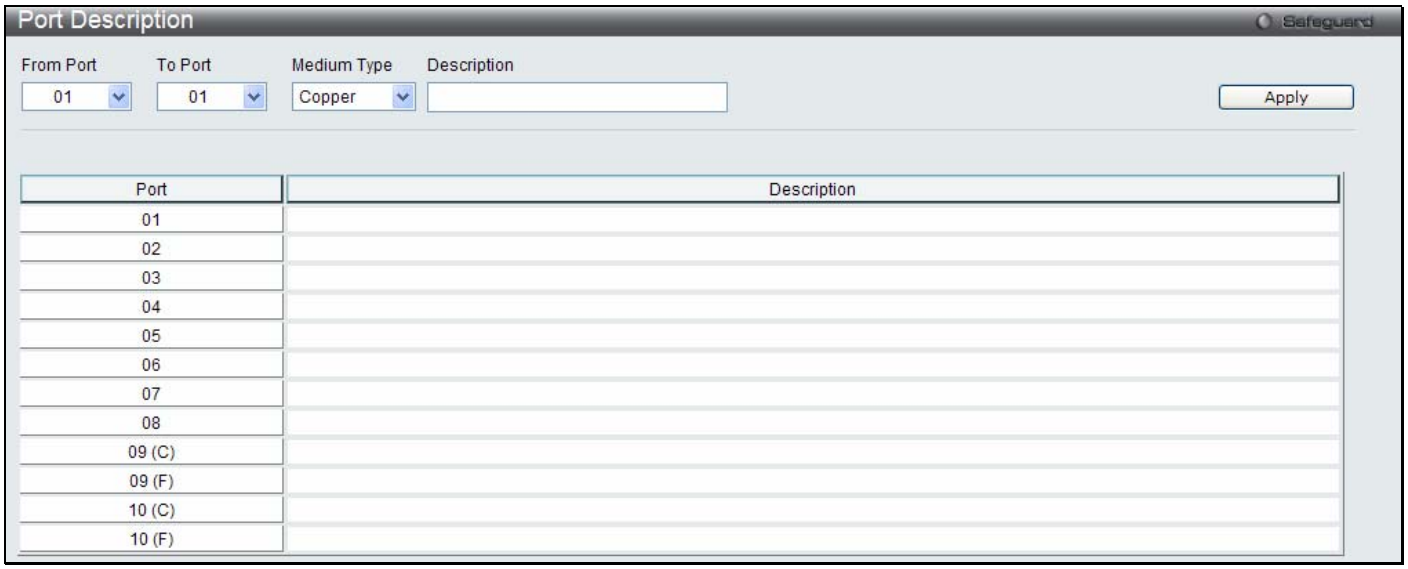


Figure 2- 10. Port Description window

Use the From Port and To Port pull-down menu to choose a port or range of ports to describe. Users may then enter a description for the chosen port(s). If configuring the Combo ports, the Medium Type defines the type of transport medium to be used, whether *Copper* or *Fiber*

Click **Apply** to set the descriptions in the **Port Description** window.

Port Error Disabled

The following window will display the information about ports that have had their connection status disabled, for reasons such as storm control or link down status.

To view the following window, click **Configuration** > **Port Configuration > Port Error Disabled**:

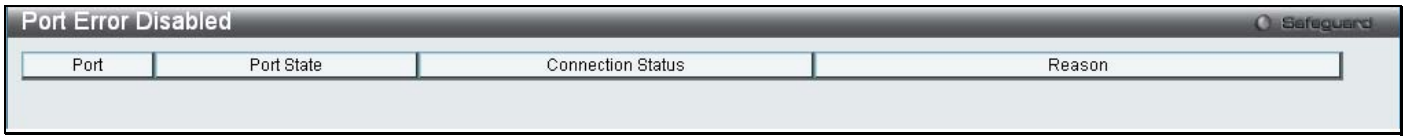


Figure 2- 11. Port Error Disabled window

The following parameters are displayed:

Parameter	Description
Port	Displays the port that has been error disabled.

Port State	Describes the current running state of the port, whether enabled or disabled.
Connection Status	This field will read the uplink status of the individual ports, whether enabled or disabled.
Reason	Describes the reason why the port has been error-disabled, such as it has become a shutdown port for storm control.

Static ARP Settings

The Address Resolution Protocol is a TCP/IP protocol that converts IP addresses into physical addresses. This table allows network managers to view, define, modify, and delete ARP information for specific devices.

Static entries can be defined in the ARP table. When static entries are defined, a permanent entry is entered and is used to translate IP addresses to MAC addresses.

To view the following window, click **Configuration** > **Static ARP Settings**:

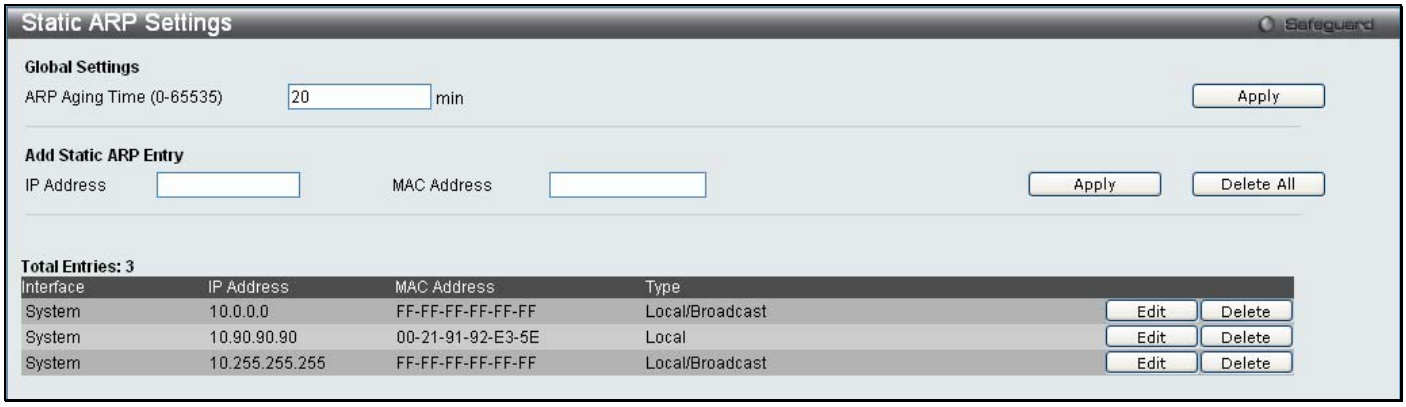


Figure 2- 12. Static ARP Settings window

The following parameters may be configured or viewed:

Parameter	Description
ARP Aging Time (0-65535)	The ARP entry age-out time, in seconds. The default is *20* minutes.
IP Address	The IP address of the ARP entry.
MAC Address	The MAC address of the ARP entry.

After entering a global ARP Aging Time in seconds, click **Apply** to allow it to take effect. The default value is *20* seconds.

After entering the IP Address and MAC Address of the Static ARP entry, click **Apply** to implement the new entry. To completely clear the static ARP entries, click the **Delete All** button.

To modify a static ARP entry, click the **Edit** button located on the right side of the entry in the ARP table at the bottom of the window.

To delete a static ARP entry, click the **Delete** button located on the right side of the entry in the static ARP table at the bottom of the window.

User Accounts

The Switch allows the control of user privileges.

To view the following window, click **Configuration** > **User Accounts**:

Figure 2- 13. User Accounts window

To add a new user, type in a User Name and New Password and retype the same password in the Confirm New Password field. Choose the level of privilege (*Admin* or *User)* from the Access Right drop-down menu.

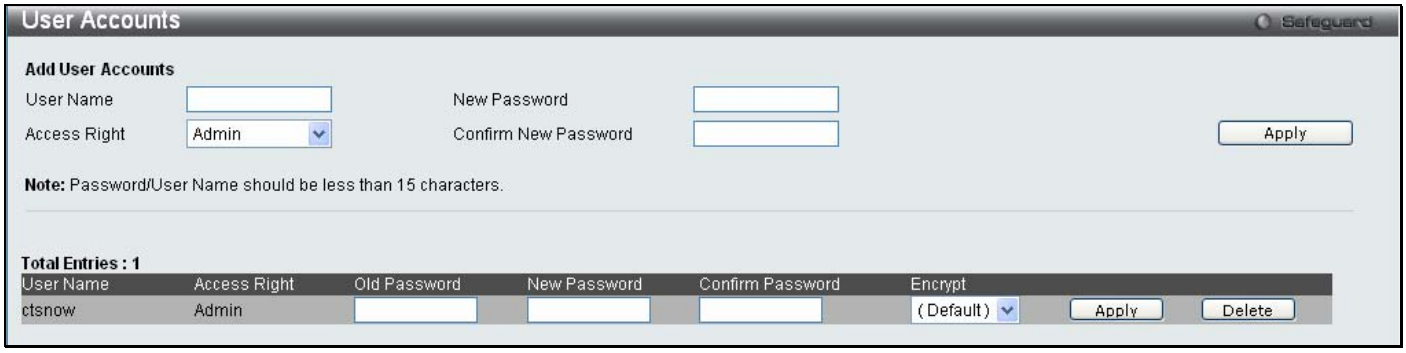


Figure 2- 14. User Accounts window (modify)

Modify or delete an existing user account in the table at the bottom of the window. To delete the user account, click the **Delete** button. To change the password, click the **Edit** button next to the entry in the table at the bottom of the window. Enter an Old Password, New Password, and retype the new password in the Confirm Password field offered, use the drop-down menu to select the type of encryption desired (*Plain Text* or *Sha 1*), and then click **Apply**. The level of privilege (*Admin* or *User*) can be viewed in the Access Right column in the table at the bottom of the window.

NOTICE: In case of lost passwords or password corruption, please refer to the Appendix D, “Password Recovery Procedure,” which will guide you through the steps necessary to resolve this issue.

Admin and User Privileges

There are two levels of user privileges, **Admin** and **User**. Some menu selections available to users with **Admin** privileges may not be available to those with **User** privileges.

The following table summarizes the Admin and User privileges:

Management	Admin	User
Configuration	Yes	Read-only
Network Monitoring	Yes	Read-only
Community Strings and Trap Stations	Yes	Read-only
Update Firmware and Configuration Files	Yes	No
System Utilities	Yes	No
Factory Reset	Yes	No
User Account Management		
Add/Update/Delete User Accounts	Yes	No
View User Accounts	Yes	No

Table 2- 1. Admin and User Privileges

System Log Configuration

The **System Log Configuration** folder contains two windows: **System Log Settings** and **System Log Host**.

System Log Settings

The Switch allow users to choose a method for which to save the switch log to the flash memory of the Switch.

To view the following window, click **Configuration** > **System Log Configuration > System Log Settings**:

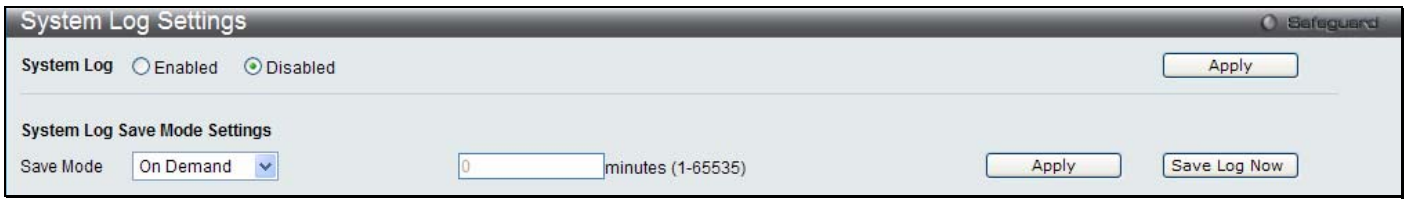


Figure 2- 15. System Log Settings window

Use the pull-down menu to choose the method for saving the switch log to the flash memory. The user has three options:

- *Time Interval* – Users who choose this method can configure a time interval by which the Switch will save the log files, in the box adjacent to this configuration field. The user may set a time between *1* and *65535* minutes.
- *On Demand* – Users who choose this method will only save log files when they manually tell the Switch to do so, either using the **Save Log** link in the **Save** folder or clicking the **Save Log Now** button on this window.
- *Log Trigger* – Users who choose this method will have log files saved to the Switch every time a log event occurs on the Switch.

The default setting is *On Demand*. Click **Apply** to save changes made. Click **Save Log Now** to immediately save log files currently on the switch.

System Log Host

The Switch can send Syslog messages to up to four designated servers using the System Log Server.

To view the following window, click **Configuration** > **System Log Configuration > System Log Host**:

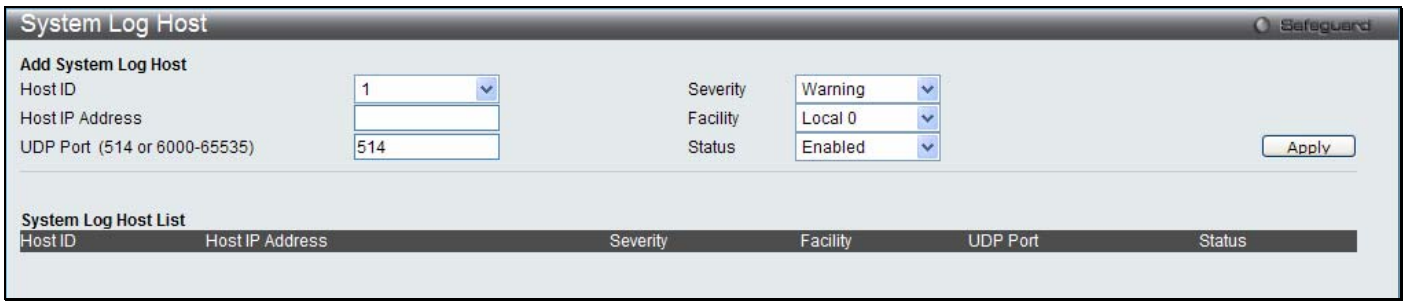


Figure 2- 16. System Log Host window

The following parameters may be configured or viewed:

Parameter	Description
Host ID	Syslog server settings index (*1* to *4*).
Host IP Address	The Ipv4 address of the Syslog server.
UDP Port (514 or 6000-65535)	Type the UDP port number used for sending Syslog messages. The default is *514*.
Severity	This drop-down menu allows you to select the level of messages that will be sent. The options are *Warning*, *Informational*, and *All*.
Facility	Use the drop-down menu to select *Local 0*, *Local 1*, *Local 2*, *Local 3*, *Local 4*, *Local 5*, *Local 6*, or *Local 7*.
Status	Choose *Enabled* or *Disabled* to activate or deactivate.

To set the System Log Server configuration, click **Apply**. To delete an entry from the System Log Host List table, click the corresponding **Delete** button next to the entry.

System Severity Settings

The Switch can be configured to allow alerts be logged or sent as a trap to an SNMP agent or both. The level at which the alert triggers either a log entry or a trap message can be set as well. Use the **System Severity Settings** window to set the criteria for alerts. The current settings are displayed below the System Severity Table.

To view the following window, click **Configuration** > **System Severity Settings**:

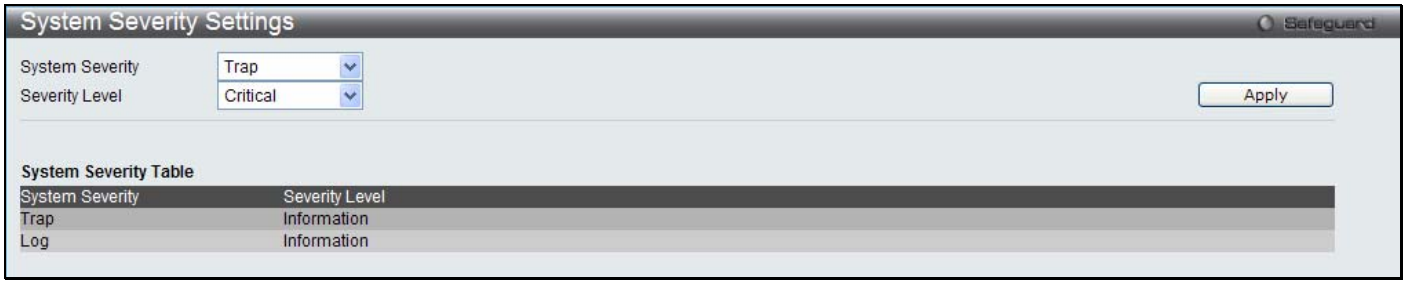


Figure 2 - 17. System Severity Settings window

The following parameters may be configured or viewed:

Parameter	Description
System Severity	Choose how the alerts are used from the drop-down menu. Select *Log* to send the alert of the Severity Type configured to the Switch's log for analysis. Choose *Trap* to send it to an SNMP agent for analysis, or select *All* to send the chosen alert type to an SNMP agent and the Switch's log for analysis.
Severity Level	Choose what level of alert will trigger sending the log entry or trap message as defined by the Severity Name. Select *Critical* to send only critical events to the Switch's log or SNMP agent. Choose *Warning* to send critical and warning events to the Switch's log or SNMP agent. Select *Information* to send informational, warning, and critical events to the Switch's log or SNMP agent.

Click **Apply** to implement the new System Severity Settings.

DHCP/BOOTP Relay

The **DHCP/BOOTP Relay** folder contains two windows: **DHCP/BOOTP Relay Global Settings** and **DHCP/BOOTP Relay Interface Settings**.

DHCP/BOOTP Relay Global Settings

Users can enable and configure DHCP/BOOTP Relay Global Settings. The relay hops count limit allows the maximum number of hops (routers) that the DHCP/BOOTP messages can be relayed through to be set. If a packet's hop count is more than the hop count limit, the packet is dropped. The range is between *1* and *16* hops, with a default value of *4*. The relay time threshold sets the minimum time (in seconds) that the Switch will wait before forwarding a BOOTREQUEST packet. If the value in the seconds field of the packet is less than the relay time threshold, the packet will be dropped. The range is between *0* and *65,535* seconds, with a default value of *0* seconds.

To view the following window, click **Configuration > DHCP/BOOTP Relay** > **DHCP/BOOTP Relay Global Settings**:

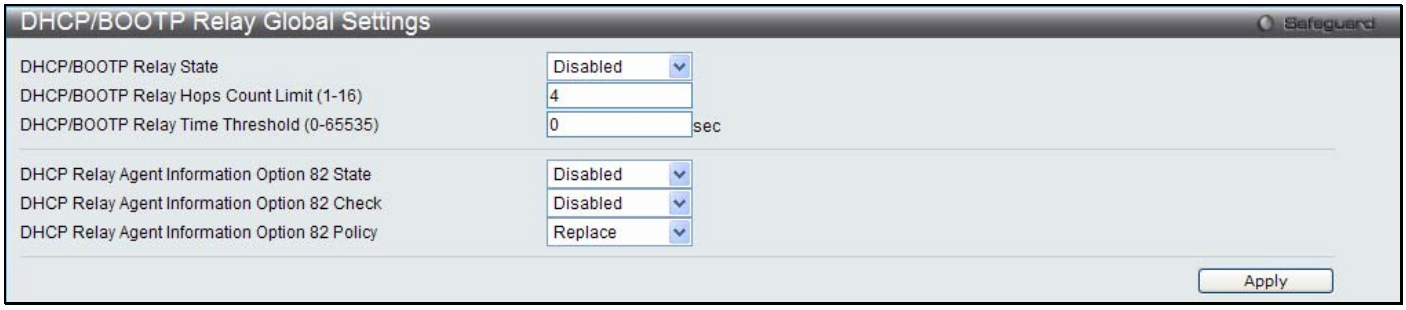


Figure 2 - 18. DHCP/ BOOTP Relay Global Settings window

The following parameters may be configured or viewed:

Parameter	Description
DHCP/BOOTP Relay State	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu. It is used to enable or disable the DHCP/BOOTP Relay service on the Switch. The default is *Disabled.*
DHCP/BOOTP Relay Hops Count Limit (1-16)	This field allows an entry between *1* and *16* to define the maximum number of router hops DHCP/BOOTP messages can be forwarded. The default hop count is *4*.
DHCP/BOOTP Relay Time Threshold (0-65535)	Allows an entry between *0* and *65535* seconds, and defines the maximum time limit for routing a DHCP/BOOTP packet. If a value of *0* is entered, the Switch will not process the value in the seconds field of the BOOTP or DHCP packet. If a non-zero value is entered, the Switch will use that value, along with the hop count to determine whether to forward a given BOOTP or DHCP packet.

DHCP Relay Agent Information Option 82 State	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu. It is used to enable or disable the DHCP Relay Agent Information Option 82 on the Switch. The default is *Disabled.* *Enabled* –When this field is toggled to *Enabled*, the relay agent will insert and remove DHCP relay information (option 82 field) in messages between DHCP servers and clients. When the relay agent receives the DHCP request, it adds the option 82 information, and the IP address of the relay agent (if the relay agent is configured), to the packet. Once the option 82 information has been added to the packet it is sent on to the DHCP server. When the DHCP server receives the packet, if the server is capable of option 82, it can implement policies like restricting the number of IP addresses that can be assigned to a single remote ID or circuit ID. Then the DHCP server echoes the option 82 field in the DHCP reply. The DHCP server unicasts the reply back to the relay agent if the request was relayed to the server by the relay agent. The switch verifies that it originally inserted the option 82 data. Finally, the relay agent removes the option 82 field and forwards the packet to the switch port that connects to the DHCP client that sent the DHCP request. *Disabled*- When the field is toggled to *Disabled*, the relay agent will not insert and remove DHCP relay information (option 82 field) in messages between DHCP servers and clients, and the check and policy settings will have no effect.
DHCP Relay Agent Information Option 82 Check	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu. It is used to enable or disable the Switches ability to check the validity of the packet's option 82 field. *Enabled* – When the field is toggled to *Enabled*, the relay agent will check the validity of the packet's option 82 field. If the switch receives a packet that contains the option 82 field from a DHCP client, the switch drops the packet because it is invalid. In packets received from DHCP servers, the relay agent will drop invalid messages. *Disabled* – When the field is toggled to *Disabled*, the relay agent will not check the validity of the packet's option 82 field.
DHCP Relay Agent Information Option 82 Policy	This field can be toggled between *Replace, Drop,* and *Keep* by using the pull-down menu. It is used to set the Switches policy for handling packets when the DHCP Relay Agent Information Option 82 Check is set to *Disabled*. The default is *Replace.* *Replace* – The option 82 field will be replaced if the option 82 field already exists in the packet received from the DHCP client. *Drop* – The packet will be dropped if the option 82 field already exists in the packet received from the DHCP client. *Keep* – The option 82 field will be retained if the option 82 field already exists in the packet received from the DHCP client.

Click **Apply** to implement any changes that have been made.

NOTE: If the Switch receives a packet that contains the option 82 field from a DHCP client and the information-checking feature is enabled, the Switch drops the packet because it is invalid. However, in some instances, users may configure a client with the option 82 field. In this situation, disable the information check feature so that the Switch does not remove the option 82 field from the packet. Users may configure the action that the Switch takes when it receives a packet with existing option 82 information by configuring the DHCP Agent Information Option 82 Policy.

The Implementation of DHCP Relay Agent Information Option 82

The **config dhcp_relay option_82** command configures the DHCP relay agent information option 82 setting of the Switch. The formats for the circuit ID sub-option and the remote ID sub-option are as follows:

NOTE: For the circuit ID sub-option of a standalone switch, the module field is always zero.

Circuit ID sub-option format:

1.	2.	3.	4.	5.	6.	7.
1	6	0	4	VLAN	Module	Port
1 byte	1 byte	1 byte	1 byte	2 bytes	1 byte	1 byte

1. Sub-option type
2. Length
3. Circuit ID type
4. Length
5. VLAN: the incoming VLAN ID of DHCP client packet.
6. Module: For a standalone switch, the Module is always 0; for a stackable switch, the Module is the Unit ID.
7. Port: The incoming port number of the DHCP client packet, the port number starts from 1.

Remote ID sub-option format:

1.	2.	3.	4.	5.
2	8	0	6	MAC address
1 byte	1 byte	1 byte	1 byte	6 bytes

1. Sub-option type
2. Length
3. Remote ID type
4. Length
5. MAC address: The Switch's system MAC address.

Figure 2 - 19. Circuit ID and Remote ID Sub-option Format

DHCP/BOOTP Relay Interface Settings

Users can set up a server, by IP address, for relaying DHCP/BOOTP information to the Switch. The user may enter a previously configured IP interface on the Switch that will be connected directly to the DHCP/BOOTP server using this window. Properly configured settings will be displayed in the DHCP/BOOTP Relay Interface Table at the bottom of the window, once the user clicks the **Apply** button. The user may add up to four server IPs per IP interface on the Switch. Entries may be deleted by clicking the corresponding **Delete** button.

To view the following window, click **Configuration** > **DHCP/BOOTP Relay** > **DHCP/BOOTP Relay Interface Settings**:

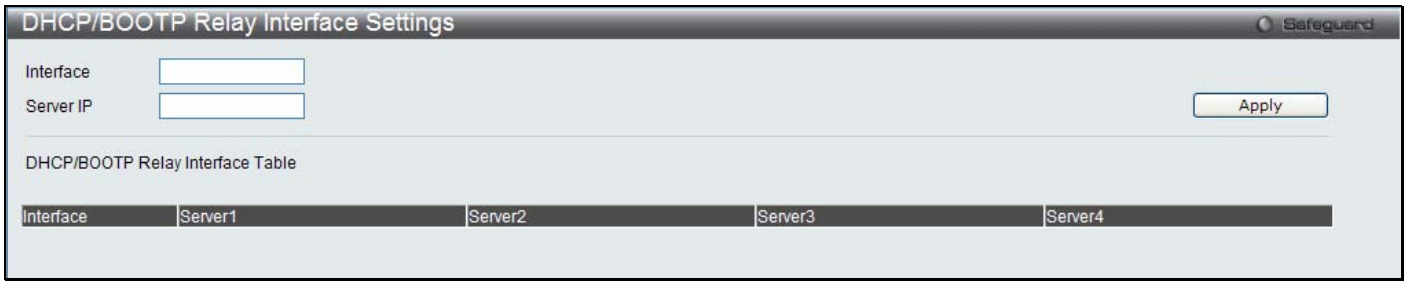


Figure 2 - 20. DHCP/BOOTP Relay Interface Settings window

The following parameters may be configured or viewed:

Parameter	Description
Interface	The IP interface on the Switch that will be connected directly to the Server.
Server IP	Enter the IP address of the DHCP/BOOTP server. Up to four server IPs can be configured per IP Interface.

Click **Apply** to include this Server IP.

DHCP Local Relay Settings

The DHCP local relay settings allows the user to add option 82 into DHCP request packets when the DHCP client gets an IP address from the same VLAN. If the DHCP local relay settings are not configured, the Switch will flood the packets to the VLAN. In order to add option 82 into the DHCP request packets, the DHCP local relay settings and the state of the Global VLAN need to be enabled.

To view the following window, click **Configuration > DHCP Local Relay Settings**:

Figure 2 - 21. DHCP Local Relay Settings window

The following parameters may be configured or viewed:

Parameter	Description
DHCP Local Relay Global State	Enable or disable the DHCP Local Relay Global State. The default is Disabled.
VLAN Name	This is the VLAN Name that identifies the VLAN the user wishes to apply the DHCP Local Relay operation.
State	Enable or disable the Config DHCP Local Relay for VLAN state.
DHCP/BOOTP Local Relay VID List	This is a list of VLAN IDs the user wishes to apply the DHCP/BOOTP Local Relay operations.

Click **Apply** to implement the new DHCP Local Relay Settings.

DHCP Auto Configuration Settings

This window is used to enable the DHCP auto configuration feature on the Switch. When enabled, the Switch is instructed to receive a configuration file from a TFTP server, which will set the Switch to become a DHCP client automatically on boot-up. To employ this method, the DHCP server must be set up to deliver the TFTP server IP address and configuration file name information in the DHCP reply packet. The TFTP server must be up and running and hold the necessary configuration file stored in its base directory when the request is received from the Switch. For more information about loading a configuration file for use by a client, see the DHCP server and/or TFTP server software instructions. The user may also consult the **Upload Log File** window description located in the **Tools** section of this manual.

If the Switch is unable to complete the DHCP auto configuration, the previously saved configuration file present in the Switch's memory will be used.

To view the following window, click **Configuration > DHCP Auto Configuration Settings**:

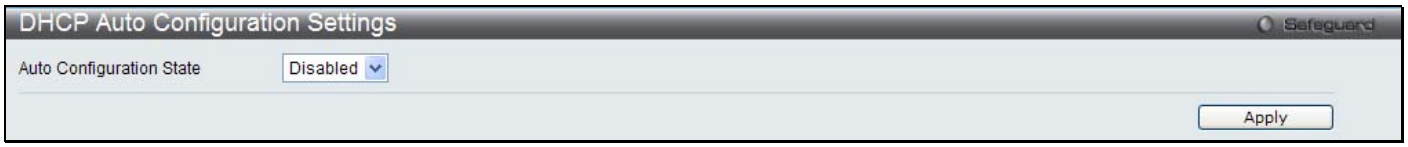


Figure 2 - 22. DHCP Auto Configuration Settings window

To enable the DHCP Auto Configuration State, use the pull-down menu to choose *Enabled* and click the **Apply** button.

The following parameter may be configured or viewed:

Parameter	Description
Auto Configuration State	Enable or disable the Switch's DHCP auto configuration feature. When enabled, the Switch is instructed to receive a configuration file from a TFTP server, which will set the Switch to become a DHCP client automatically on boot-up. To employ this method, the DHCP server must be set up to deliver the TFTP server IP address and configuration file name information in the DHCP reply packet. The TFTP server must be up and running and hold the necessary configuration file stored in its base directory when the request is received from the Switch.

Click **Apply** to set the DHCP Auto Configuration State.

MAC Address Aging Time

Users can configure the MAC Address aging time on the Switch.

To view the following window, click **Configuration > MAC Address Aging Time**:

Figure 2 - 23. MAC Address Aging Time window

Enter a value between *10* and *875* seconds.

The following parameter may be configured or viewed:

Parameter	Description
MAC Address Aging Time (10-875)	This field specifies the length of time a learned MAC Address will remain in the forwarding table without being accessed (that is, how long a learned MAC Address is allowed to remain idle). To change this, type in a different value representing the MAC address age-out time in seconds. The MAC Address Aging Time can be set to any value between *10* and *875* seconds. The default setting is *300* seconds.

Click **Apply** to set the MAC Address Aging Time.

Web Settings

Users can configure the Web settings on the Switch.

To view the following window, click **Configuration > Web Settings**:

Figure 2 - 24. Web Settings window

The following parameters may be configured or viewed:

Parameter	Description
Web Status	Web-based management is Enabled by default. If you choose to disable this by clicking Disabled, you will lose the ability to configure the system through the web interface as soon as these settings are applied.
Port	The TCP port number used for Web-based management of the Switch. The “well-known” TCP port for the Web protocol is *80*.

Click **Apply** to set the web settings.

Telnet Settings

Users can configure Telnet Settings on the Switch.

To view the following window, click **Configuration > Telnet Settings**:

Figure 2 - 25. Telnet Settings window

The following parameters may be configured or viewed:

Parameter	Description
Telnet Status	Telnet configuration is Enabled by default. If you do not want to allow configuration of the system through Telnet choose Disabled.
Port (1-65535)	The TCP port number used for Telnet management of the Switch. The “well-known” TCP port for the Telnet protocol is *23*.

Click **Apply** to set the Telnet setting.

Password Encryption

Users can configure Password Encryption on the Switch.

To view the following window, click **Configuration > Password Encryption**:

Figure 2 - 26. Password Encryption window

The following parameter may be configured or viewed:

Parameter	Description
Password Encryption Status	Password encryption is Disabled by default. To enable password encryption, click the Enabled radio button.

Click **Apply** to set the password encryption.

CLI Paging Settings

Users can stop the scrolling of multiple pages beyond the limits of the console when using the Command Line Interface.

To view the following window, click **Configuration > CLI Paging Settings**:

Figure 2 - 27. CLI Paging Settings window

The following parameter may be configured or viewed:

Parameter	Description
CLI Paging Status	Command Line Interface paging stops each page at the end of the console. This allows you to stop the scrolling of multiple pages of text beyond the limits of the console. CLI Paging is Enabled by default. To disable it, click the Disabled radio button.

Click **Apply** to set the CLI Paging setting.

Firmware Information

Users can view, set the next boot-up status, and delete current firmware images stored on the Switch. To set firmware as the boot-up firmware the next time the Switch is restarted, click the **Set Boot** button. To remove the firmware from this window, click the **Delete** button.

To view the following window, click **Configuration > Firmware Information**:

Figure 2 - 28. Firmware Information window

The following parameters may be configured or viewed:

Parameter	Description
ID	States the image ID number of the firmware in the Switch's memory. The Switch can store 2 firmware images for use. Image ID 1 will be the default boot-up firmware for the Switch unless otherwise configured by the user.
Version	States the firmware version.
Size	States the size of the corresponding firmware, in bytes.
Update Time	States the specific time the firmware version was downloaded to the Switch.

From	States the IP address of the origin of the firmware. There are five ways firmware may be downloaded to the Switch. Boot-up files are denoted by an asterisk (*) next to the file. R – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Console Serial Port (RS-232). T – If the IP address has this letter attached to it, it denotes a firmware upgrade through Telnet. S – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Simple Network Management Protocol (SNMP). W – If the IP address has this letter attached to it, it denotes a firmware upgrade through the web-based management interface. SSH – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Secure Shell (SSH). SIM – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Single IP Management feature.
User	States the user who downloaded the firmware. This field may read “Anonymous” or “Unknown” for users that are not identified.

Power Saving Settings

This window allows the user to implement the Switch’s built-in power saving feature. When power saving is Enabled, a port which has a link down status will be turned off to save power to the Switch. This will not effect the port’s capabilities when the port status is link up.

To view the following window, click **Configuration > Power Saving Settings**:

Figure 2 - 29. Power Saving Settings window

The following parameter may be configured or viewed:

Parameter	Description
Power Saving State	Power savings is Enabled by default. To disable this feature, click the Disabled radio button.

Click **Apply** to set the password encryption.

Dual Configuration Settings

Users can display dual configuration settings on the Switch. The Switch allows two firmware images to be stored in its memory and either can be configured to be the boot-up firmware for the Switch. The user may select a boot-up firmware image for the Switch by clicking the **Boot** button to select it. This will instruct the Switch to use this newly selected firmware the next time the Switch is restarted. To delete a firmware image, click the **Delete** button. The **Active** button indicates active firmware.

To view the following window, click **Configuration > Dual Configuration Settings**:

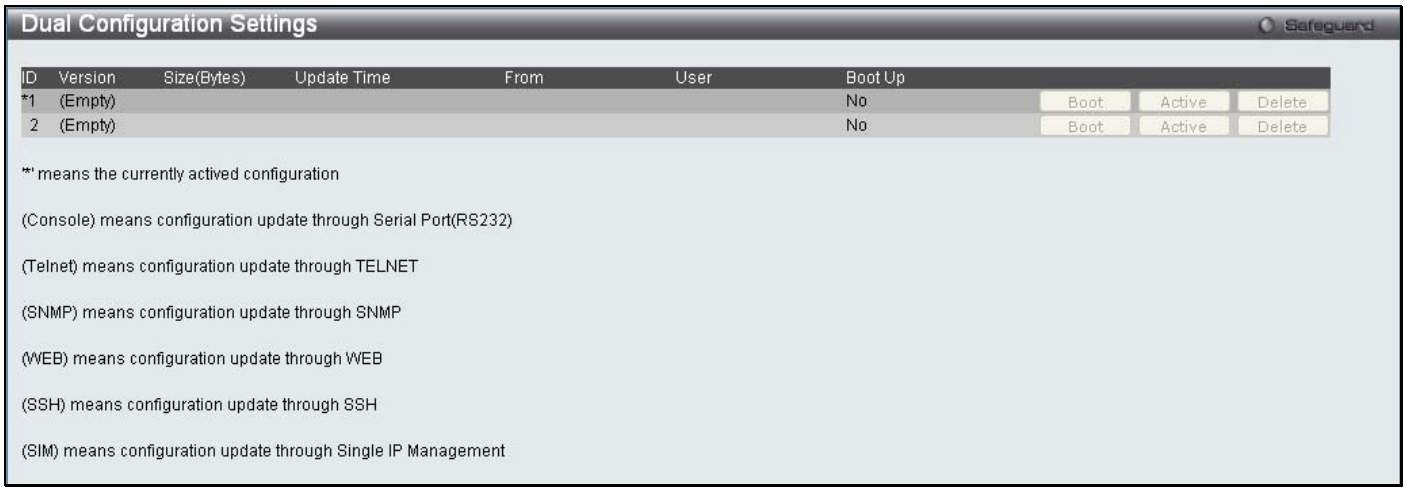

Dual Configuration Settings
Safeguard
ID Version Size(Bytes) Update Time From User Boot Up
*1 (Empty) No Boot Active Delete
2 (Empty) No Boot Active Delete
'*' means the currently actived configuration
(Console) means configuration update through Serial Port(RS232)
(Telnet) means configuration update through TELNET
(SNMP) means configuration update through SNMP
(WEB) means configuration update through WEB
(SSH) means configuration update through SSH
(SIM) means configuration update through Single IP Management

Figure 2 - 30. Dual Configuration Settings window

The following parameters may be configured or viewed:

Parameter	Description
ID	States the image ID number of the firmware in the Switch's memory. The Switch can store 2 firmware images for use. Image ID 1 will be the default boot-up firmware for the Switch unless otherwise configured by the user.
Version	States the firmware version.
Size	States the size of the corresponding firmware, in bytes.
Update Time	States the specific time the firmware version was downloaded to the Switch.
From	States the IP address of the origin of the firmware. There are five ways firmware may be downloaded to the Switch. Boot-up files are denoted by an asterisk (*) next to the file. R – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Console Serial Port (RS-232). T – If the IP address has this letter attached to it, it denotes a firmware upgrade through Telnet. S – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Simple Network Management Protocol (SNMP). W – If the IP address has this letter attached to it, it denotes a firmware upgrade through the web-based management interface. SSH – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Secure Shell network protocol. SIM – If the IP address has this letter attached to it, it denotes a firmware upgrade through the Single IP Management feature.
User	States the user who downloaded the firmware. This field may read "Anonymous" or "Unknown" for users that are not identified.
Boot	An asterisk indicates which firmware is used for boot-up by the Switch.

SMTP Settings

SMTP or Simple Mail Transfer Protocol is a function of the Switch that will send switch events to mail recipients based on e-mail addresses entered in the window below. The Switch is to be configured as a client of SMTP while the server is a remote device that will receive messages from the Switch, place the appropriate information into an e-mail and deliver it to recipients configured on the Switch. This can benefit the Switch administrator by simplifying the management of small workgroups or wiring closets, increasing the speed of handling emergency Switch events, and enhancing security by recording questionable events occurring on the Switch.

Users can set up the SMTP server for the Switch, along with setting e-mail addresses to which switch log files can be sent when a problem arises on the Switch.

To view the following window, click **Configuration > SMTP Settings**:

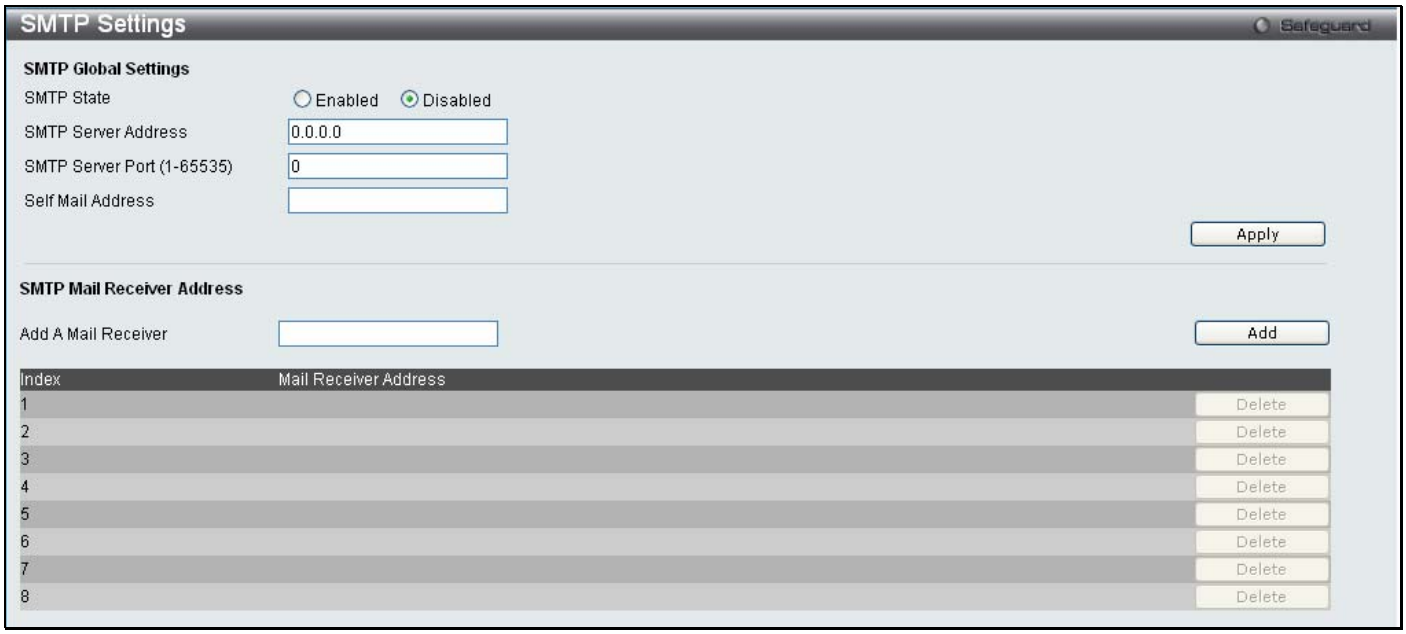


Figure 2 - 31. SMTP Settings window

The following parameters may be configured or viewed:

Parameter	Description
SMTP State	Use the radio button to enable or disable the SMTP service on this device.
SMTP Server Address	Enter the IP address of the SMTP server on a remote device. This will be the device that sends out the mail for you.
SMTP Server Port (1-65535)	Enter the virtual port number that the Switch will connect with on the SMTP server. The common port number for SMTP is *25*, yet a value between *1* and *65535* can be chosen.
Self Mail Address	Enter the e-mail address from which mail messages will be sent. This address will be the “from” address on the e-mail message sent to a recipient. Only one self-mail address can be configured for this Switch. This string can be no more that 64 alphanumeric characters.
Add A Mail Receiver	Enter an e-mail address and click the **Add** button. Up to eight e-mail addresses can be added per Switch. To delete these addresses from the Switch, click the corresponding **Delete** button in the SMTP Mail Receiver Address table at the bottom of the window.

Ping Test

Users can Ping either an IPv4 address or an IPv6 address. Ping is a small program that sends ICMP Echo packets to the IP address you specify. The destination node then responds to or "echoes" the packets sent from the Switch. This is very useful to verify connectivity between the Switch and other nodes on the network.

To view the following window, click **Configuration** > **Ping Test**:

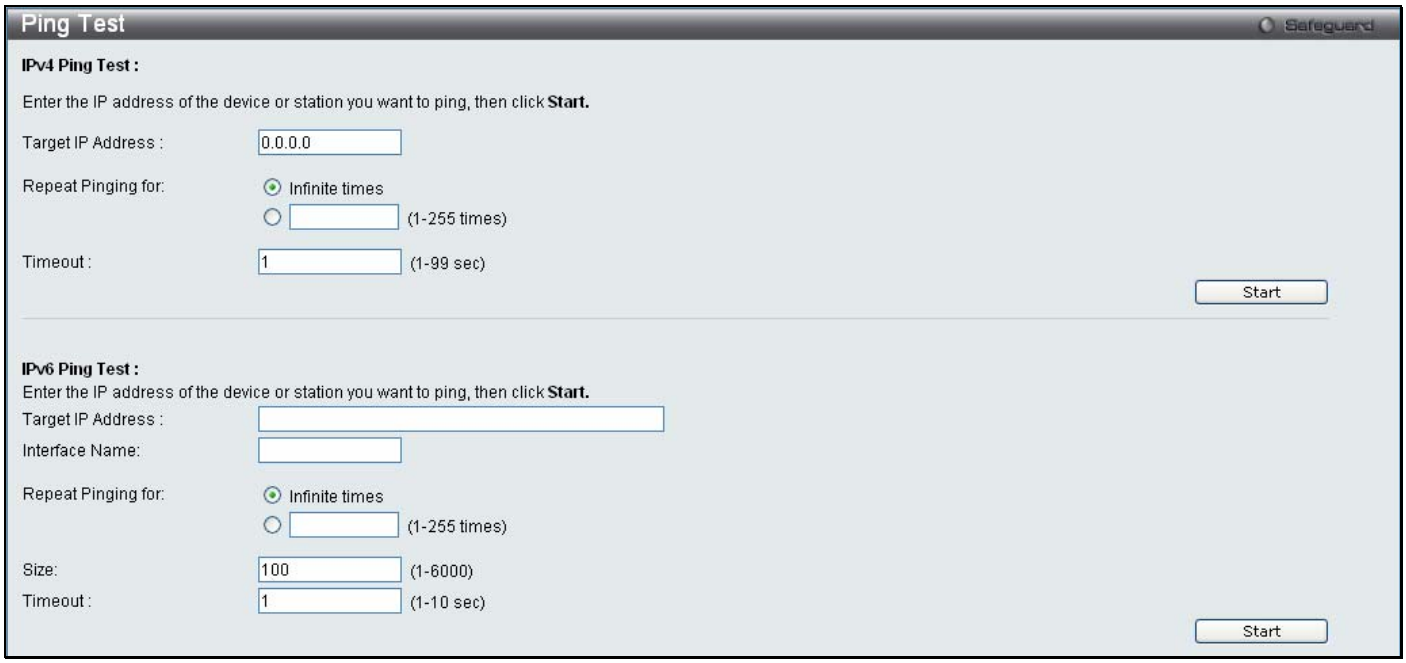


Figure 2 - 32. Ping Test window

The user may click the Infinite times radio button, in the Repeat Pinging for field, which will tell the ping program to keep sending ICMP Echo packets to the specified IP address until the program is stopped. The user may opt to choose a specific number of times to ping the Target IP Address by clicking its radio button and entering a number between *1* and *255*. Click **Start** to initiate the Ping program.

The following parameters may be configured or viewed:

Parameter	Description
Target IP Address	Enter an IP address to be Pinged.
Interface Name	For IPv6 only, enter the name of the interface to be Pinged.
Repeat Pinging for	Enter the number of times desired to attempt to Ping either the IPv4 address or the IPv6 address configured in this window. Users may enter a number of times between *1* and *255*.
Size	For IPv6 only, enter a value between *1* and *6000*. The default is *100*.
Timeout	For IPv4, select a timeout period between *1* and *99* seconds for this Ping message to reach its destination. For IPv6, select a timeout period between *1* and *10* seconds for this Ping message to reach its destination. In either case, if the packet fails to find the IP address in this specified time, the Ping packet will be dropped.

Click **Start** to initialize the Ping program.

SNTP Settings

SNTP or Simple Network Time Protocol is used by the Switch to synchronize the clock of the computer.

The **SNTP Settings** folder contains two windows: **Time Settings** and **TimeZone Settings**.

Time Settings

Users can configure the time settings for the Switch.

To view the following window, click **Configuration** > **SNTP Settings** > **Time Settings**:

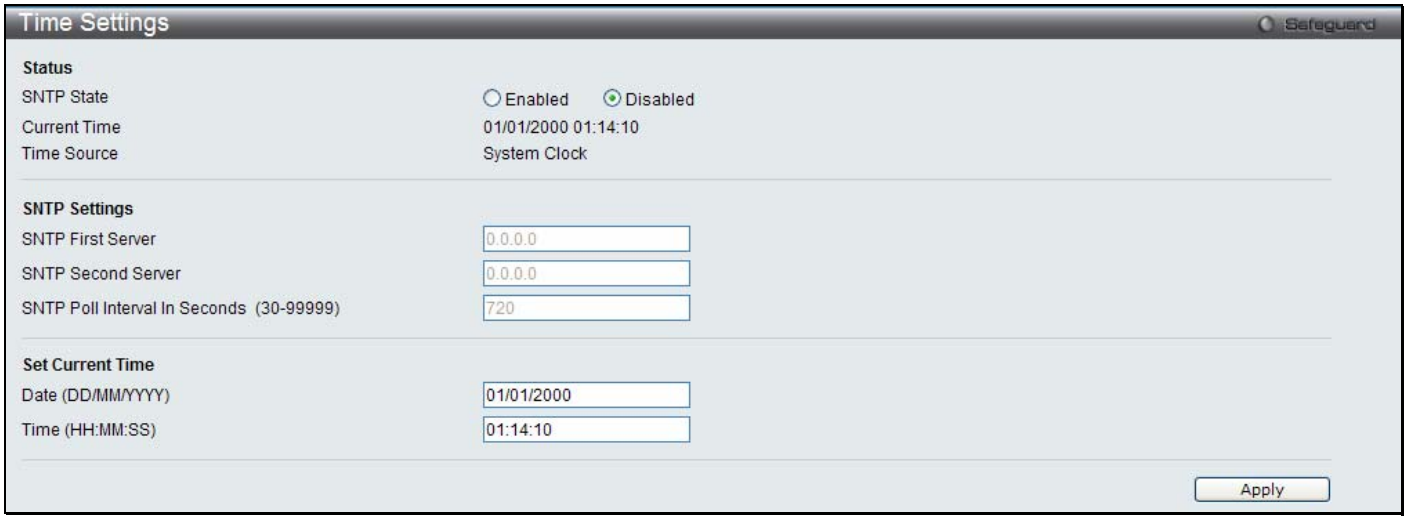


Figure 2 - 33. Time Settings window

The following parameters can be set or are displayed:

Parameter	Description
Status	
SNTP State	Use this radio button to enable or disable SNTP.
Current Time	Displays the Current Time.
Time Source	Displays the time source for the system.
SNTP Settings	
SNTP First Server	The IP address of the primary server from which the SNTP information will be taken.
SNTP Secondary Server	The IP address of the secondary server from which the SNTP information will be taken.
SNTP Poll Interval In Seconds (30-99999)	The interval, in seconds, between requests for updated SNTP information.
Set Current Time	
Date (DD/MM/YYYY)	Enter the current day, month, and year to update the system clock.
Time (HH:MM:SS)	Enter the current time in hours, minutes, and seconds.

Click **Apply** to implement your changes.

TimeZone Settings

Users can configure time zones and Daylight Savings Time settings for SNTP.

To view the following window, click **Configuration** > **SNTP Settings > TimeZone Settings**:

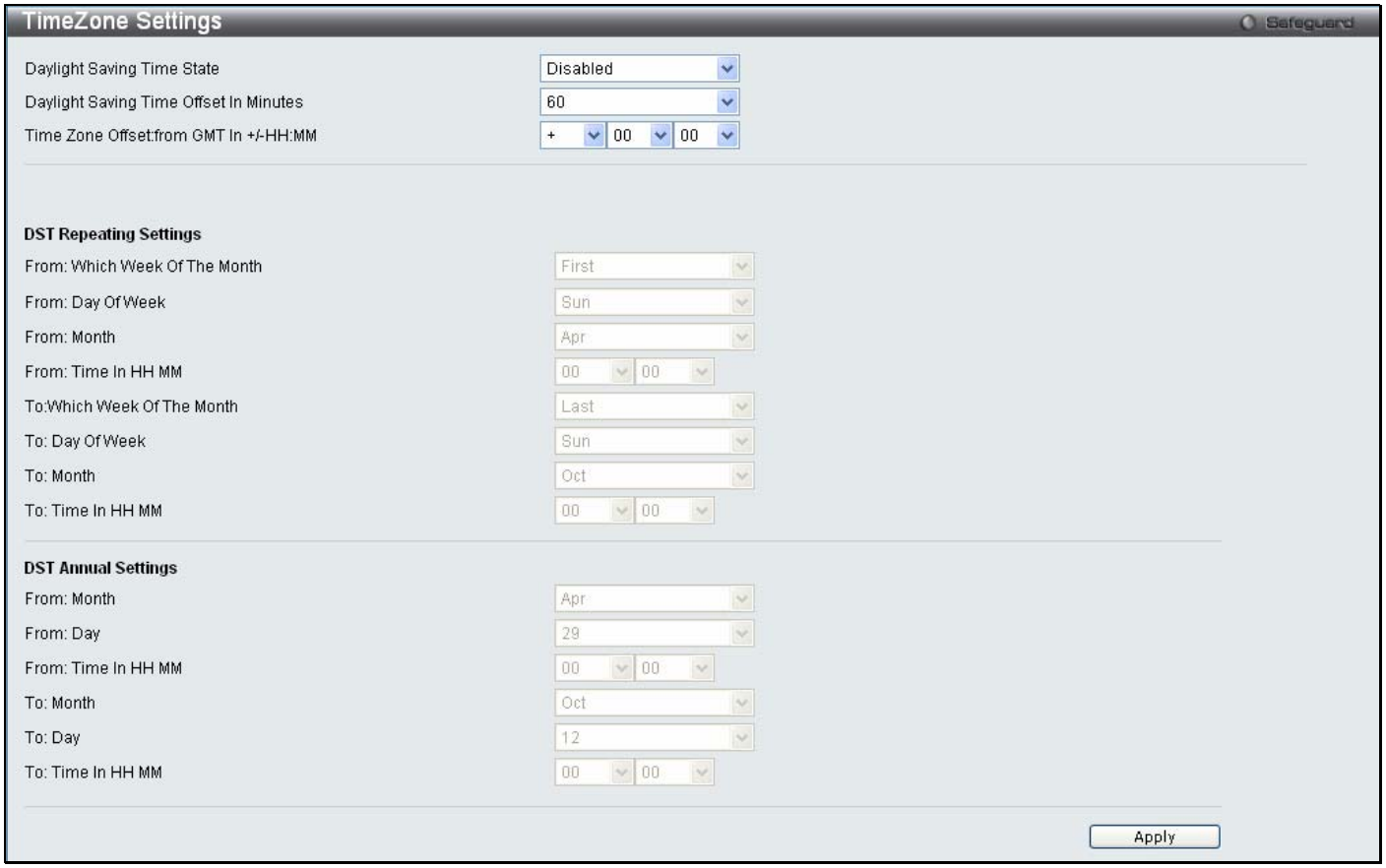


Figure 2 - 34. TimeZone Settings window

The following parameters can be set:

Parameter	Description
Daylight Saving Time State	Use this pull-down menu to enable or disable the DST Settings.
Daylight Saving Time Offset In Minutes	Use this pull-down menu to specify the amount of time that will constitute your local DST offset – *30*, *60*, *90*, or *120* minutes.
Time Zone Offset From GMT In +/- HH:MM	Use these pull-down menus to specify your local time zone's offset from Greenwich Mean Time (GMT.)

DST Repeating Settings – Using repeating mode will enable DST seasonal time adjustment. Repeating mode requires that the DST beginning and ending date be specified using a formula. For example, specify to begin DST on Saturday during the second week of April and end DST on Sunday during the last week of October.	
From: Which Week Of The Month	Enter the week of the month that DST will start.
From: Day Of Week	Enter the day of the week that DST will start on.
From: Month	Enter the month DST will start on.
From: Time In HH:MM	Enter the time of day that DST will start on.
To: Which Week Of The Month	Enter the week of the month the DST will end.
To: Day Of Week	Enter the day of the week that DST will end.

To: Month	Enter the month that DST will end.
To: Time In HH:MM	Enter the time DST will end.
DST Annual Settings – Using annual mode will enable DST seasonal time adjustment. Annual mode requires that the DST beginning and ending date be specified concisely. For example, specify to begin DST on April 3 and end DST on October 14.	
From: Month	Enter the month DST will start on, each year.
From: Day	Enter the day of the month DST will start on, each year.
From: Time In HH:MM	Enter the time of day DST will start on, each year.
To: Month	Enter the month DST will end on, each year.
To: Day	Enter the day of the month DST will end on, each year.
To: Time In HH:MM	Enter the time of day that DST will end on, each year.

Click **Apply** to implement changes made to this window.

MAC Notification Settings

MAC Notification is used to monitor MAC addresses learned and entered into the forwarding database.

The **MAC Notification Settings** folder contains two windows: **MAC Notification Settings** and **MAC Notification Port Settings**.

MAC Notification Global Settings

This window allows you to globally set MAC notification on the Switch.

To view the following window, click **Configuration** > **MAC Notification Settings > MAC Notification Global Settings**:

Figure 2 - 35. MAC Notification Global Settings window

The following parameters may be viewed and modified:

Parameter	Description
State	Enable or disable MAC notification globally on the Switch
Interval (1-2147483647 sec)	The time in seconds between notifications.
History Size (1-500)	The maximum number of entries listed in the history log used for notification. Up to 500 entries can be specified.

Click **Apply** to implement your changes.

MAC Notification Port Settings

Users can set MAC notification for individual ports on the Switch.

To view the following window, click **Configuration** > **MAC Notification Settings > MAC Notification Port Settings**:

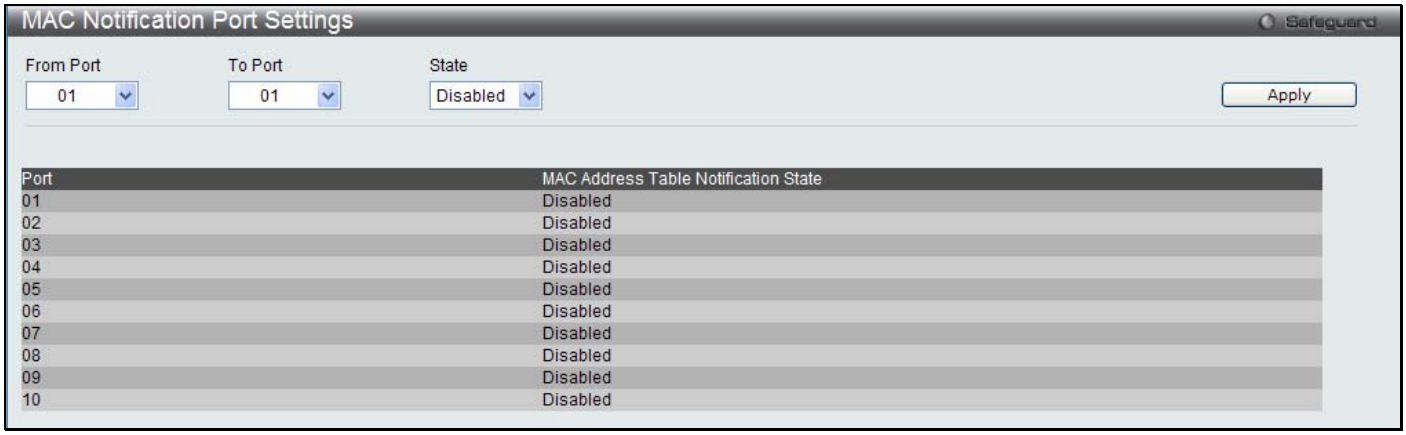


Figure 2 - 36. MAC Notification Port Settings window

To change MAC notification settings for a port or group of ports on the Switch, configure the following parameters.

Parameter	Description
From Port	Select a beginning port to enable for MAC notification using the pull-down menu.
To Port	Select an ending port to enable for MAC notification using the pull-down menu.
State	Enable MAC Notification for the ports selected using the pull-down menu.

Click **Apply** to implement changes made.

SNMP Settings

Simple Network Management Protocol (SNMP) is an OSI Layer 7 (Application Layer) designed specifically for managing and monitoring network devices. SNMP enables network management stations to read and modify the settings of gateways, routers, switches, and other network devices. Use SNMP to configure system features for proper operation, monitor performance and detect potential problems in the Switch, switch group or network.

Managed devices that support SNMP include software (referred to as an agent), which runs locally on the device. A defined set of variables (managed objects) is maintained by the SNMP agent and used to manage the device. These objects are defined in a Management Information Base (MIB), which provides a standard presentation of the information controlled by the on-board SNMP agent. SNMP defines both the format of the MIB specifications and the protocol used to access this information over the network.

The Switch supports the SNMP versions 1, 2c, and 3. The three versions of SNMP vary in the level of security provided between the management station and the network device.

In SNMP v.1 and v.2, user authentication is accomplished using 'community strings', which function like passwords. The remote user SNMP application and the Switch SNMP must use the same community string. SNMP packets from any station that has not been authenticated are ignored (dropped).

The default community strings for the Switch used for SNMP v.1 and v.2 management access are:

- **public** – Allows authorized management stations to retrieve MIB objects.
- **private** – Allows authorized management stations to retrieve and modify MIB objects.

SNMPv3 uses a more sophisticated authentication process that is separated into two parts. The first part is to maintain a list of users and their attributes that are allowed to act as SNMP managers. The second part describes what each user on that list can do as an SNMP manager.

The Switch allows groups of users to be listed and configured with a shared set of privileges. The SNMP version may also be set for a listed group of SNMP managers. Thus, you may create a group of SNMP managers that are allowed to view read-only information or receive traps using SNMPv1 while assigning a higher level of security to another group, granting read/write privileges using SNMPv3.

Using SNMPv3 individual users or groups of SNMP managers can be allowed to perform or be restricted from performing specific SNMP management functions. The functions allowed or restricted are defined using the Object Identifier (OID) associated with a specific MIB. An additional layer of security is available for SNMPv3 in that SNMP messages may be encrypted. To read more about how to configure SNMPv3 settings for the Switch read the next section.

Traps

Traps are messages that alert network personnel of events that occur on the Switch. The events can be as serious as a reboot (someone accidentally turned OFF the Switch), or less serious like a port status change. The Switch generates traps and sends them to the trap recipient (or network manager). Typical traps include trap messages for Authentication Failure, Topology Change and Broadcast\Multicast Storm.

MIBs

The Switch in the Management Information Base (MIB) stores management and counter information. The Switch uses the standard MIB-II Management Information Base module. Consequently, values for MIB objects can be retrieved from any SNMP-based network management software. In addition to the standard MIB-II, the Switch also supports its own proprietary enterprise MIB as an extended Management Information Base. Specifying the MIB Object Identifier may also retrieve the proprietary MIB. MIB values can be either read-only or read-write.

The Switch incorporates a flexible SNMP management for the switching environment. SNMP management can be customized to suit the needs of the networks and the preferences of the network administrator. Use the SNMP V3 menus to select the SNMP version used for specific tasks.

The Switch supports the Simple Network Management Protocol (SNMP) versions 1, 2c, and 3. The administrator can specify the SNMP version used to monitor and control the Switch. The three versions of SNMP vary in the level of security provided between the management station and the network device.

SNMP settings are configured using the menus located on the SNMP V3 folder of the Web manager. Workstations on the network that are allowed SNMP privileged access to the Switch can be restricted with the Management Station IP Address menu.

SNMP Global State Settings

SNMP global state settings can be enabled or disabled.

To view the following window, click **Configuration** > **SNMP Settings** > **SNMP Global State Settings**:

Figure 2 - 37. SNMP Global State Settings window

Click the **Apply** button to let your change take effect.

SNMP View Table

Users can assign views to community strings that define which MIB objects can be accessed by a remote SNMP manager.

To view the following window, click **Configuration** > **SNMP Settings** > **SNMP View Table**:

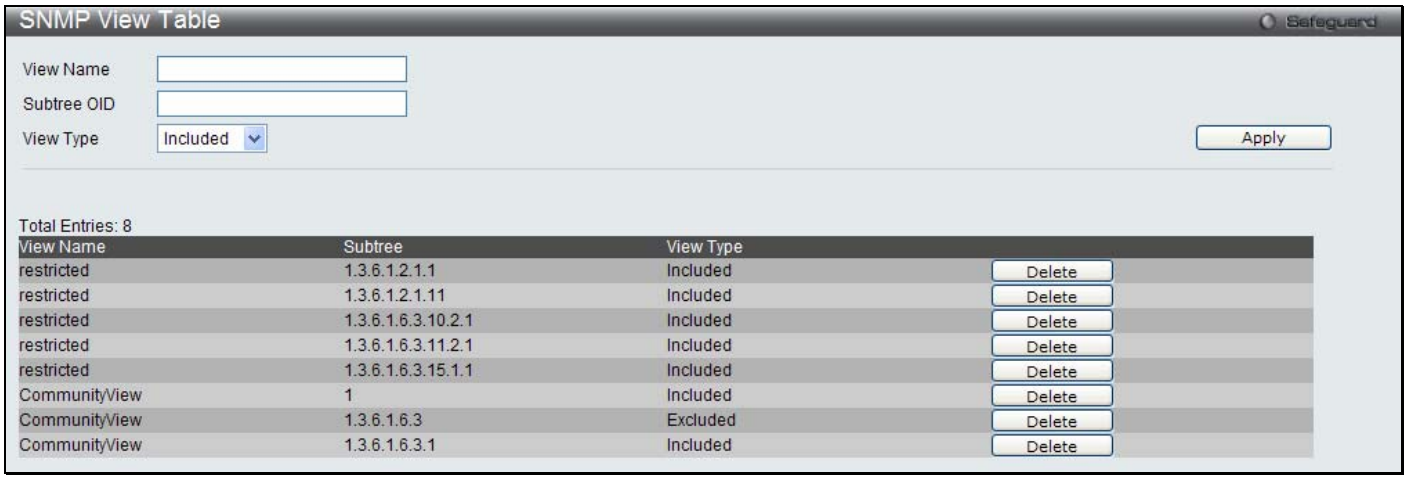


Figure 2 - 38. SNMP View Table window

To delete an existing SNMP View Table entry, click the **Delete** button corresponding to the entry to delete. To create a new entry, enter the information above the table and then click the **Apply** button.

The SNMP Group created with this table maps SNMP users (identified in the SNMP User Table) to the views created in the previous window.

The following parameters can set:

Parameter	Description
View Name	Type an alphanumeric string of up to 32 characters. This is used to identify the new SNMP view being created.
Subtree OID	Type the Object Identifier (OID) Subtree for the view. The OID identifies an object tree (MIB tree) that will be included or excluded from access by an SNMP manager.
View Type	Select Included to include this object in the list of objects that an SNMP manager can access. Select Excluded to exclude this object from the list of objects that an SNMP manager can access.

To implement your new settings, click **Apply**.

SNMP Group Table

An SNMP Group created with this table maps SNMP users (identified in the SNMP User Table) to the views created in the previous window.

To view the following window, click **Configuration** > **SNMP Settings** > **SNMP Group Table**:

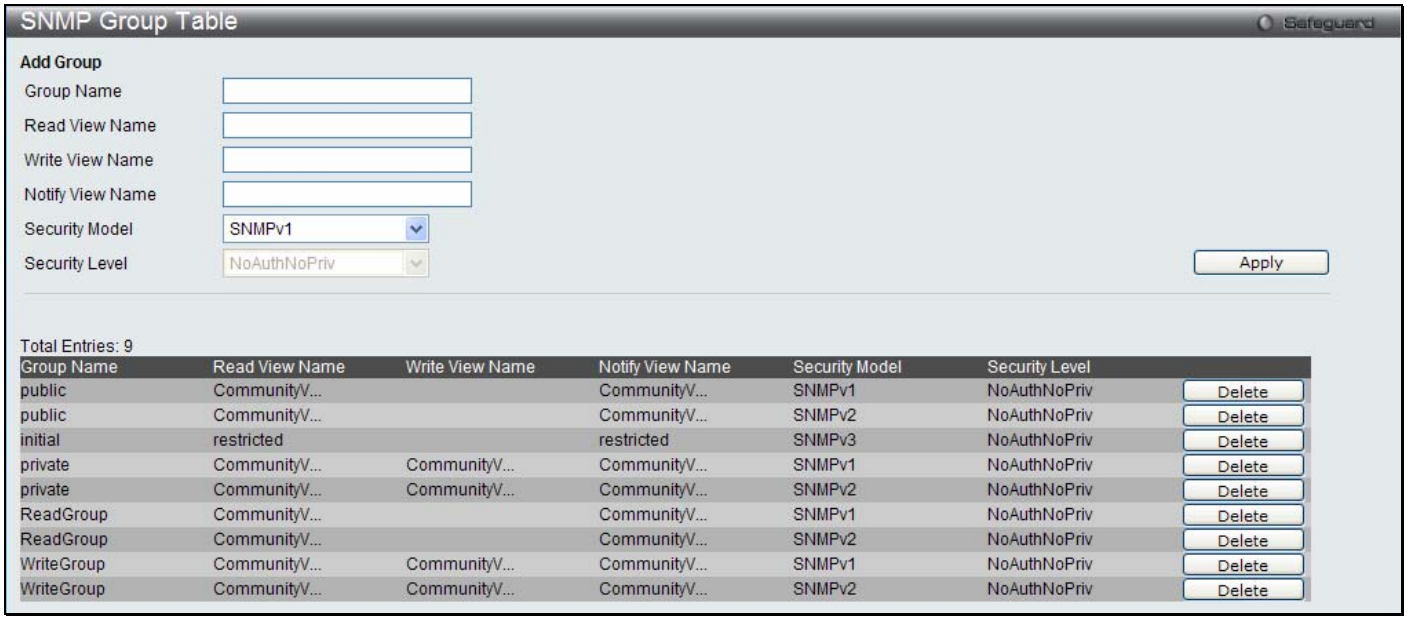


Figure 2 - 39. SNMP Group Table window

To delete an existing SNMP Group Table entry, click the **Delete** button next to the corresponding entry.

To add a new entry to the Switch's SNMP Group Table, enter the information at the top of the window and then click **Apply**.

The following parameters can set:

Parameter	Description
Group Name	Type an alphanumeric string of up to 32 characters. This is used to identify the new SNMP group of SNMP users.
Read View Name	This name is used to specify the SNMP group created can request SNMP messages.
Write View Name	Specify a SNMP group name for users that are allowed SNMP write privileges to the Switch's SNMP agent.
Notify View Name	Specify a SNMP group name for users that can receive SNMP trap messages generated by the Switch's SNMP agent.
Security Model	*SNMPv1* – Specifies that SNMP version 1 will be used. *SNMPv2* – Specifies that SNMP version 2c will be used. The SNMPv2 supports both centralized and distributed network management strategies. It includes improvements in the Structure of Management Information (SMI) and adds some security features. *SNMPv3* – Specifies that the SNMP version 3 will be used. SNMPv3 provides secure access to devices through a combination of authentication and encrypting packets over the network.
Security Level	The Security Level settings only apply to SNMPv3. *NoAuthNoPriv* – Specifies that there will be no authorization and no encryption of packets sent between the Switch and a remote SNMP manager. *AuthNoPriv* – Specifies that authorization will be required, but there will be no encryption of packets sent between the Switch and a remote SNMP manager. *AuthPriv* – Specifies that authorization will be required, and that packets sent between the Switch and a remote SNMP manger will be encrypted.

To implement your new settings, click **Apply**.

SNMP User Table

This window displays all of the SNMP User's currently configured on the Switch.

To view the following window, click **Configuration > SNMP User Table**:

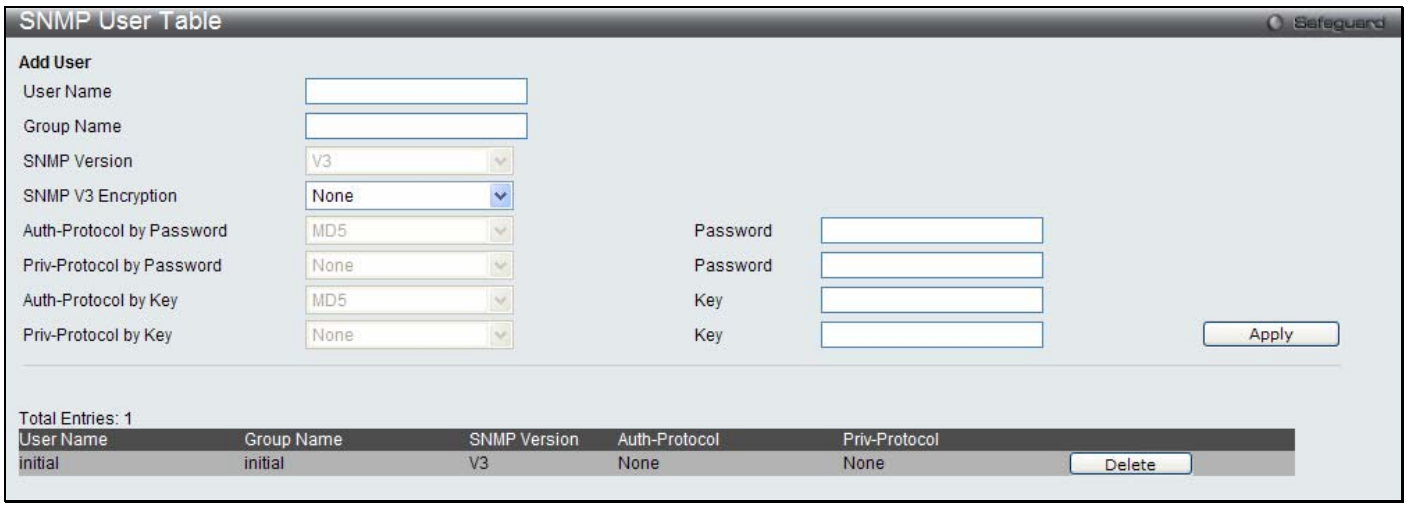


Figure 2 - 40. SNMP User Table window

To delete an existing SNMP User Table entry, click the **Delete** button corresponding to the entry to delete.

To display the detailed entry for a given user, click on the **View** button. This will open the **SNMP User Table Display** window, as shown below.

The following parameters are displayed:

Parameter	Description
User Name	An alphanumeric string of up to 32 characters. This is used to identify the SNMP users.
Group Name	This name is used to specify the SNMP group created can request SNMP messages.
SNMP Version	*V3* – Indicates that SNMP version 3 is in use.
SNMP V3 Encryption	Use the drop-down menu to enable encryption for SNMP V3. This is only operable in SNMP V3 mode. The choices are *None*, *Password*, or *Key*.
Auth-Protocol	*MD5* – Specifies that the HMAC-MD5-96 authentication level will be used. This field is only operable when *V3* is selected in the SNMP Version field and the Encryption field has been checked. This field will require the user to enter a password. *SHA* – Specifies that the HMAC-SHA authentication protocol will be used. This field is only operable when *V3* is selected in the SNMP Version field and the Encryption field has been checked. This field will require the user to enter a password.
Priv-Protocol	*None* – Specifies that no authorization protocol is in use. *DES* – Specifies that DES 56-bit encryption is in use, based on the CBC-DES (DES-56) standard. This field is only operable when *V3* is selected in the SNMP Version field and the Encryption field has been checked. This field will require the user to enter a password between 8 and 16 alphanumeric characters.

To implement changes made, click **Apply**.

SNMP Community Table

Users can create an SNMP community string to define the relationship between the SNMP manager and an agent. The community string acts like a password to permit access to the agent on the Switch. One or more of the following characteristics can be associated with the community string:

- An Access List of IP addresses of SNMP managers that are permitted to use the community string to gain access to the Switch's SNMP agent.
- Any MIB view that defines the subset of all MIB objects will be accessible to the SNMP community.
- Read/write or read-only level permission for the MIB objects accessible to the SNMP community.

To view the following window, click **SNMP Settings** > **Configuration** > **SNMP Community Table**:

Figure 2 - 41. SNMP Community Table window

The following parameters can set:

Parameter	Description
Community Name	Type an alphanumeric string of up to 32 characters that is used to identify members of an SNMP community. This string is used like a password to give remote SNMP managers access to MIB objects in the Switch's SNMP agent.
View Name	Type an alphanumeric string of up to 32 characters that is used to identify the group of MIB objects that a remote SNMP manager is allowed to access on the Switch. The view name must exist in the SNMP View Table.
Access Right	*Read Only* – Specifies that SNMP community members using the community string created can only read the contents of the MIBs on the Switch. *Read Write* – Specifies that SNMP community members using the community string created can read from, and write to the contents of the MIBs on the Switch.

To implement the new settings, click **Apply**. To delete an entry from the SNMP Community Table, click the **Delete** button corresponding to the entry to delete.

SNMP Host Table

Users can set up SNMP trap recipients for IPv4.

To view the following window, click **Configuration** > **SNMP Settings** > **SNMP Host Table**:

Figure 2 - 42. SNMP Host Table window

To add a new entry to the Switch's SNMP Host Table, enter the information at the top of the window and then click the **Apply** button. To delete an existing SNMP Host Table entry, click the **Delete** button corresponding to the entry to delete.

The following parameters can set:

Parameter	Description
Host IP Address	Type the IP address of the remote management station that will serve as the SNMP host for the Switch.
SNMP Version	*V1* – To specifies that SNMP version 1 will be used. *V2c* – To specify that SNMP version 2c will be used. *V3-NoAuth-NoPriv* – To specify that the SNMP version 3 will be used, with a NoAuth-NoPriv security level. *V3-Auth-NoPriv* – To specify that the SNMP version 3 will be used, with an Auth-NoPriv security level. *V3-Auth-Priv* – To specify that the SNMP version 3 will be used, with an Auth-Priv security level.
Community String / SNMP V3 User Name	Type in the community string or SNMP V3 user name as appropriate.

To implement your new settings, click **Apply**.

SNMP v6Host Table

Users can set up SNMP trap recipients for IPv6.

To view the following window, click **Configuration** > **SNMP Settings** > **SNMP v6Host Table**:

Figure 2 - 43. SNMP v6Host Table window

To add a new entry to the Switch's SNMP v6Host Table, enter the information at the top of the window and then click the **Apply** button. To delete an existing SNMP v6Host Table entry, click the **Delete** button corresponding to the entry to delete.

The following parameters can set:

Parameter	Description
Host IPv6 Address	Type the IP address of the remote management station that will serve as the SNMP host for the Switch.
SNMP Version	*V1* – To specifies that SNMP version 1 will be used. *V2c* – To specify that SNMP version 2c will be used. *V3-NoAuth-NoPriv* – To specify that the SNMP version 3 will be used, with a NoAuth-NoPriv security level. *V3-Auth-NoPriv* – To specify that the SNMP version 3 will be used, with an Auth-NoPriv security level. *V3-Auth-Priv* – To specify that the SNMP version 3 will be used, with an Auth-Priv security level.
Community String / SNMP V3 User Name	Type in the community string or SNMP V3 user name as appropriate.

To implement your new settings, click **Apply**.

SNMP Engine ID

The Engine ID is a unique identifier used for SNMP V3 implementations on the Switch.

To view the following window, click **Configuration** > **SNMP Settings > SNMP Engine ID**:

Figure 2 - 44. SNMP Engine ID window

To change the Engine ID, type the new Engine ID value in the space provided.

The following parameter can be set:

Parameter	Description
Engine ID	The SNMP engine ID displays the identification of the SNMP engine on the Switch. The default value is suggested in RFC2271. The very first bit is 1, and the first four octets are set to the binary equivalent of the agent's SNMP management private enterprise number as assigned by IANA (D-Link is 171). The fifth octet is 03 to indicate the rest is the MAC address of this device. The sixth to eleventh octets is the MAC address.

To implement your new settings, click **Apply**.

SNMP Trap Configuration

Users can enable and disable SNMP trap support and SNMP authentication failure trap support, respectively.

To view the following window, click **Configuration > SNMP Settings > SNMP Trap Configuration**:

Figure 2 - 45. SNMP Trap Configuration window

To enable or disable the Traps State and/or the Authenticate Traps State, use the corresponding pull-down menu to change and click **Apply**.

RMON

Users can enable and disable remote monitoring (RMON) status for the SNMP function on the Switch.

To view the following window, click **Configuration > SNMP Settings > RMON**:

Figure 2 - 46. RMON window

To enable or disable RMON for SNMP, use the radio button and click **Apply**.

Single IP Management

Simply put, D-Link Single IP Management is a concept that will stack switches together over Ethernet instead of using stacking ports or modules. There are some advantages in implementing the "Single IP Management" feature:

1. SIM can simplify management of small workgroups or wiring closets while scaling the network to handle increased bandwidth demand.
2. SIM can reduce the number of IP address needed in your network.
3. SIM can eliminate any specialized cables for stacking connectivity and remove the distance barriers that typically limit your topology options when using other stacking technology.

Switches using D-Link Single IP Management (labeled here as SIM) must conform to the following rules:

- SIM is an optional feature on the Switch and can easily be enabled or disabled through the Command Line Interface or Web Interface. SIM grouping has no effect on the normal operation of the Switch in the user's network.
- There are three classifications for switches using SIM. The **Commander Switch (CS)**, which is the master switch of the group, **Member Switch (MS)**, which is a switch that is recognized by the CS a member of a SIM group, and a **Candidate Switch (CaS)**, which is a Switch that has a physical link to the SIM group but has not been recognized by the CS as a member of the SIM group.
- A SIM group can only have one Commander Switch (CS).
- All switches in a particular SIM group must be in the same IP subnet (broadcast domain). Members of a SIM group cannot cross a router.
- A SIM group accepts up to 32 switches (numbered 1-32), not including the Commander Switch (numbered 0).
- There is no limit to the number of SIM groups in the same IP subnet (broadcast domain), however a single switch can only belong to one group.
- If multiple VLANs are configured, the SIM group will only utilize the default VLAN on any switch.
- SIM allows intermediate devices that do not support SIM. This enables the user to manage switches that are more than one hop away from the CS.

The SIM group is a group of switches that are managed as a single entity. The Switch may take on three different roles:

1. **Commander Switch (CS)** – This is a switch that has been manually configured as the controlling device for a group, and takes on the following characteristics:
    - It has an IP Address.
    - It is not a command switch or member switch of another Single IP group.
    - It is connected to the member switches through its management VLAN.
2. **Member Switch (MS)** – This is a switch that has joined a single IP group and is accessible from the CS, and it takes on the following characteristics:
    - It is not a CS or MS of another IP group.
    - It is connected to the CS through the CS management VLAN.
3. **Candidate Switch (CaS)** – This is a switch that is ready to join a SIM group but is not yet a member of the SIM group. The Candidate Switch may join the SIM group of the Switch by manually configuring it to be a MS of a SIM group. A switch configured as a CaS is not a member of a SIM group and will take on the following characteristics:
    - It is not a CS or MS of another Single IP group.
    - It is connected to the CS through the CS management VLAN

The following rules also apply to the above roles:

- Each device begins in a Candidate state.
- CSs must change their role to CaS and then to MS, to become a MS of a SIM group. Thus, the CS cannot directly be converted to a MS.
- The user can manually configure a CS to become a CaS.

- A MS can become a CaS by:
  - Being configured as a CaS through the CS.
  - If report packets from the CS to the MS time out.
- The user can manually configure a CaS to become a CS
- The CaS can be configured through the CS to become a MS.

After configuring one switch to operate as the CS of a SIM group, additional DGS-3200 Series switches may join the group by manually configuring the Switch to be a MS. The CS will then serve as the in band entry point for access to the MS. The CS's IP address will become the path to all MS's of the group and the CS's Administrator's password, and/or authentication will control access to all MS's of the SIM group.

With SIM enabled, the applications in the CS will redirect the packet instead of executing the packets. The applications will decode the packet from the administrator, modify some data, then send it to the MS. After execution, the CS may receive a response packet from the MS, which it will encode and send it back to the administrator.

When a CaS becomes a MS, it automatically becomes a member of the first SNMP community (include read/write and read only) to which the CS belongs. However, if a MS has its own IP address, it can belong to SNMP communities to which other switches in the group, including the CS, do not belong.

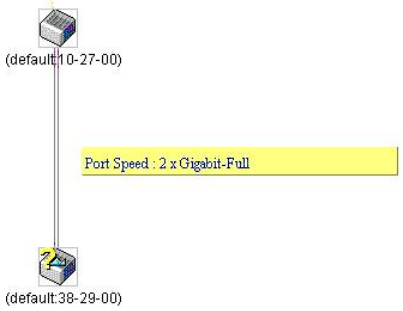
Upgrade to v1.61

To better improve SIM management, the DGS-3200 Series switches have been upgraded to version 1.61 in this release. Many improvements have been made, including:

4. The Commander Switch (CS) now has the capability to automatically rediscover member switches that have left the SIM group, either through a reboot or web malfunction. This feature is accomplished through the use of Discover packets and Maintenance packets that previously set SIM members will emit after a reboot. Once a MS has had its MAC address and password saved to the CS's database, if a reboot occurs in the MS, the CS will keep this MS information in its database and when a MS has been rediscovered, it will add the MS back into the SIM tree automatically. No configuration will be necessary to rediscover these switches.

There are some instances where pre-saved MS switches cannot be rediscovered. For example, if the Switch is still powered down, if it has become the member of another group, or if it has been configured to be a Commander Switch, the rediscovery process cannot occur.

2. The topology map now includes new features for connections that are a member of a port trunking group. It will display the speed and number of Ethernet connections creating this port trunk group, as shown in the adjacent picture.



5. This version will support switch upload and downloads for firmware, configuration files and log files, as follows:

- **Firmware** – The switch now supports MS firmware downloads from a TFTP server.
- **Configuration Files** – This switch now supports downloading and uploading of configuration files both to (for configuration restoration) and from (for configuration backup) MS's, using a TFTP server.
- **Log** – The Switch now supports uploading MS log files to a TFTP server.

6. The user may zoom in and zoom out when utilizing the topology window to get a better, more defined view of the configurations.

Single IP Settings

The Switch is set as a Candidate (CaS) as the factory default configuration and Single IP Management is disabled.

To enable SIM for the Switch using the Web interface, click **Configuration** > **Single IP Management** > **SIM Settings**:

Figure 2 - 47. Single IP Settings window for Candidate (disabled)

Change the **SIM State** to *Enabled* using the pull-down menu and click **Apply**. The window will then refresh and the **Single IP Settings** window will look like this:

Figure 2 - 48. Single IP Settings window for Candidate (enabled)

Parameter	Description
SIM State	Use the pull-down menu to either enable or disable the SIM state on the Switch. *Disabled* will render all SIM functions on the Switch inoperable.
Role State	Use the pull-down menu to change the SIM role of the Switch. The two choices are: *Candidate* – A Candidate Switch (CaS) is not the member of a SIM group but is connected to a Commander Switch. This is the default setting for the SIM role of the Switch. *Commander* – Choosing this parameter will make the Switch a Commander Switch (CS). The user may join other switches to this Switch, over Ethernet, to be part of its SIM group. Choosing this option will also enable the Switch to be configured for SIM.
Group Name	Enter a Group Name in this textbox. This is optional.
Discovery Interval (30-90)	The user may set the discovery protocol interval, in seconds that the Switch will send out discovery packets. Returning information to a Commander Switch will include information about other switches connected to it. (Ex. MS, CaS). The user may set the Discovery Interval from *30* to *90* seconds. The default value is *30* seconds.
Hold Time Count (100-255)	This parameter may be set for the time, in seconds; the Switch will hold information sent to it from other switches, utilizing the Discovery Interval. The user may set the hold time from *100* to *255* seconds. The default value is *100* seconds.

Click **Apply** to implement the settings changed. After enabling the Switch to be a Commander Switch (CS), the **Single IP Management** folder will then contain four added links to aid the user in configuring SIM through the web, including **Topology**, **Firmware Upgrade**, **Configuration Backup/Restore** and **Upload Log**. The **Single IP Settings** window should look like this:

Figure 2 - 49. Single IP Settings window for Commander (enabled)

Topology

This window will be used to configure and manage the Switch within the SIM group and requires Java script to function properly on your computer.

The Java Runtime Environment on your server should initiate and lead you to the **Topology** window, as seen below.

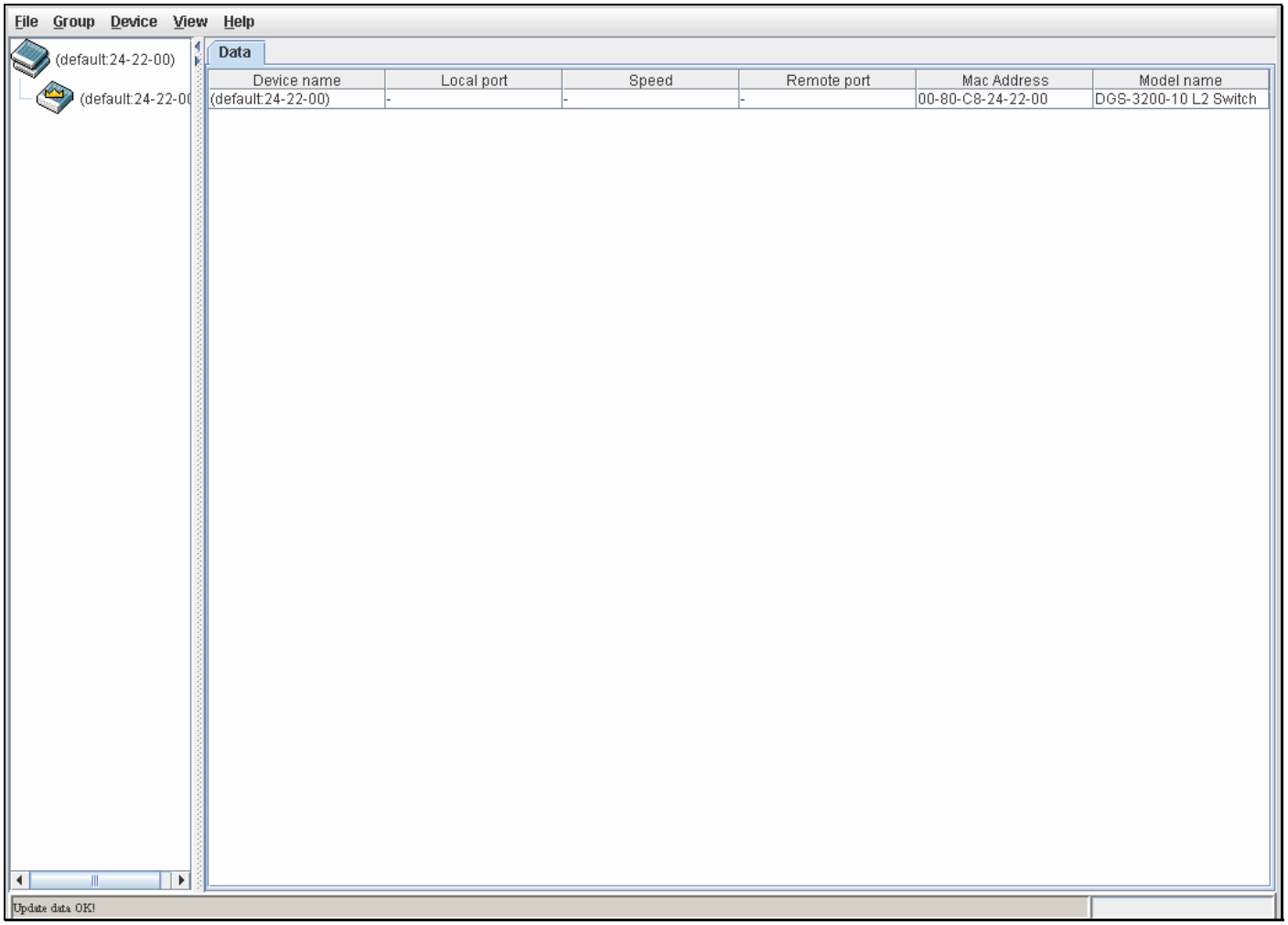


Figure 2 - 50. Topology window

The **Topology** window holds the following information on the **Data** tab:

Parameter	Description
Device Name	This field will display the Device Name of the switches in the SIM group configured by the user. If no device is configured by the name, it will be given the name default and tagged with the last six digits of the MAC Address to identify it.
Local Port	Displays the number of the physical port on the CS that the MS or CaS is connected to. The

	CS will have no entry in this field.
Speed	Displays the connection speed between the CS and the MS or CaS.
Remote Port	Displays the number of the physical port on the MS or CaS to which the CS is connected. The CS will have no entry in this field.
MAC Address	Displays the MAC Address of the corresponding Switch.
Model Name	Displays the full Model Name of the corresponding Switch.

To view the **Topology View** window, open the **View** drop-down menu in the toolbar and then click **Topology**, which will open the following Topology Map. This window will refresh itself periodically (20 seconds by default).

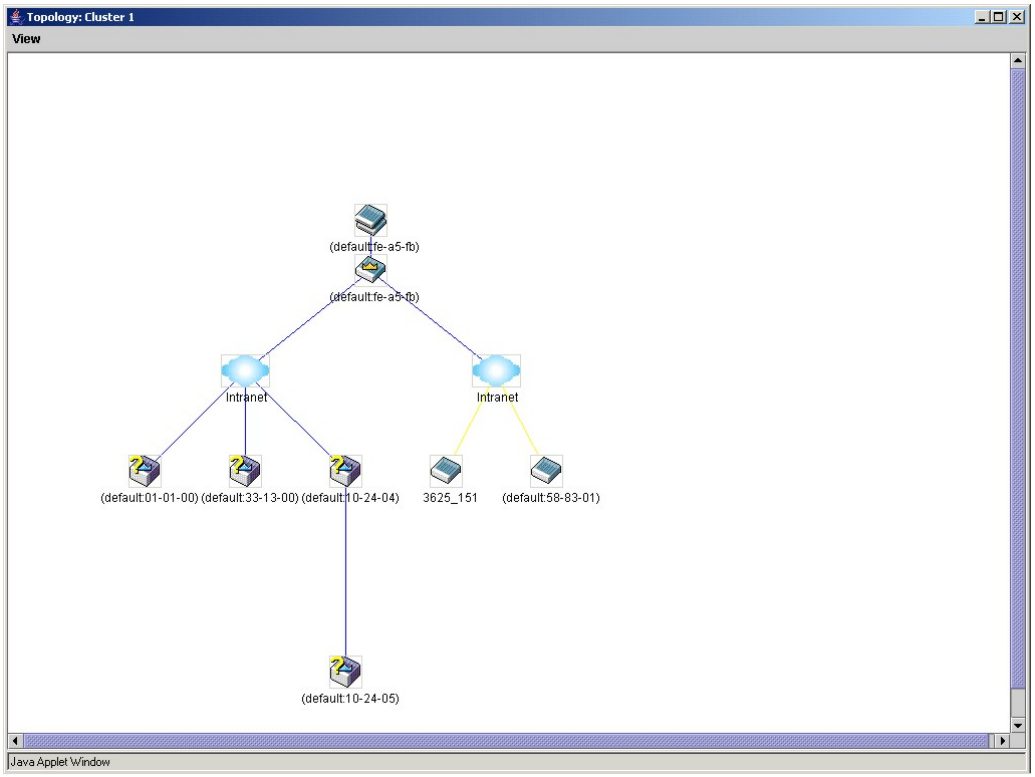


Figure 2 - 51. Topology View window

This window will display how the devices within the Single IP Management Group connect to other groups and devices. Possible icons on this window are as follows:

Icon	Description
	Group
	Layer 2 commander switch
	Layer 3 commander switch
	Commander switch of other group
	Layer 2 member switch.
	Layer 3 member switch

	Member switch of other group
	Layer 2 candidate switch
	Layer 3 candidate switch
	Unknown device
	Non-SIM devices

Tool Tips

In the Topology view window, the mouse plays an important role in configuration and in viewing device information. Setting the mouse cursor over a specific device in the topology window (tool tip) will display the same information about a specific device as the Tree view does. See the window below for an example.

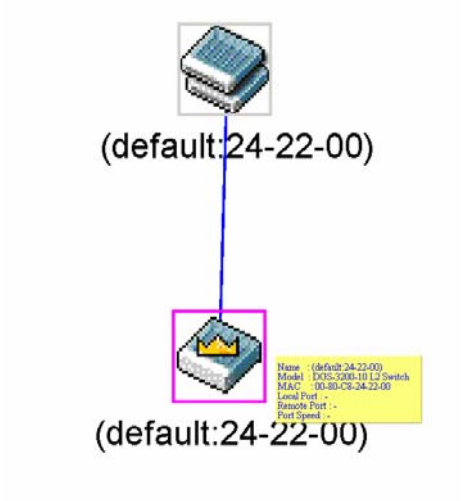


Figure 2 - 52. Device Information Utilizing the Tool Tip

Setting the mouse cursor over a line between two devices will display the connection speed between the two devices, as shown below.

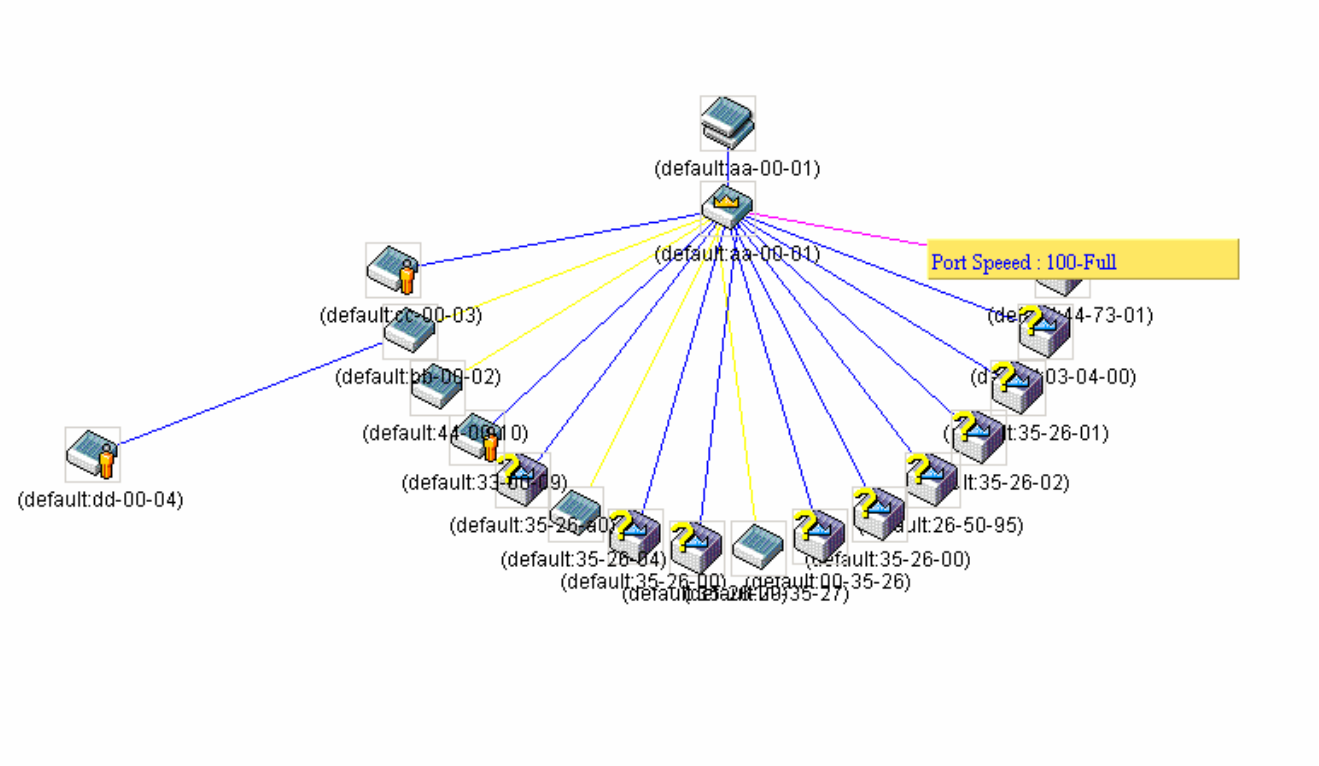


Figure 2 - 53. Port Speed Utilizing the Tool Tip

Right-Click

Right-clicking on a device will allow the user to perform various functions, depending on the role of the Switch in the SIM group and the icon associated with it.

Group Icon

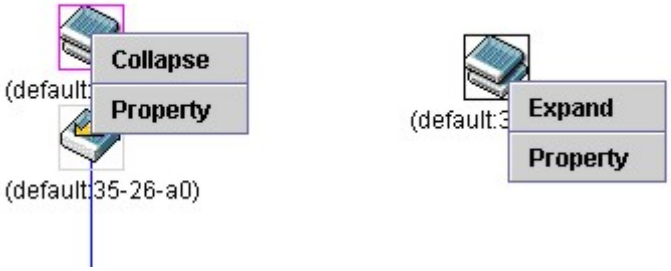


Figure 2 - 54. Right-Clicking a Group Icon

The following options may appear for the user to configure:

- **Collapse** – To collapse the group that will be represented by a single icon.
- **Expand** – To expand the SIM group, in detail.
- **Property** – To pop up a window to display the group information.

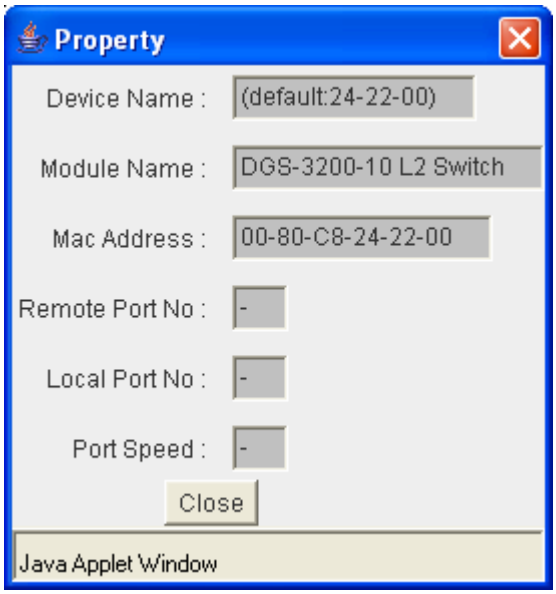


Figure 2 - 55. Property window

Parameter	Description
Device Name	This field will display the Device Name of the switches in the SIM group configured by the user. If no Device Name is configured by the name, it will be given the name default and tagged with the last six digits of the MAC Address to identify it.
Module Name	Displays the full module name of the switch that was right-clicked.
MAC Address	Displays the MAC Address of the corresponding Switch.
Remote Port No.	Displays the number of the physical port on the MS or CaS that the CS is connected to. The CS will have no entry in this field.
Local Port No.	Displays the number of the physical port on the CS that the MS or CaS is connected to. The CS will have no entry in this field.
Port Speed	Displays the connection speed between the CS and the MS or CaS

Commander Switch Icon

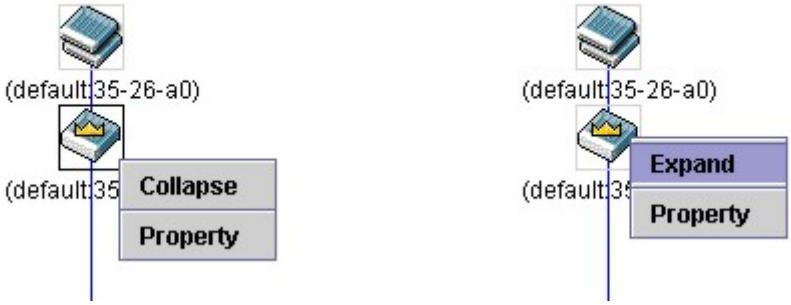


Figure 2 - 56. Right-Clicking a Commander Icon

The following options may appear for the user to configure:

- **Collapse** – To collapse the group that will be represented by a single icon.
- **Expand** – To expand the SIM group, in detail.
- **Property** – To pop up a window to display the group information.

Member Switch Icon

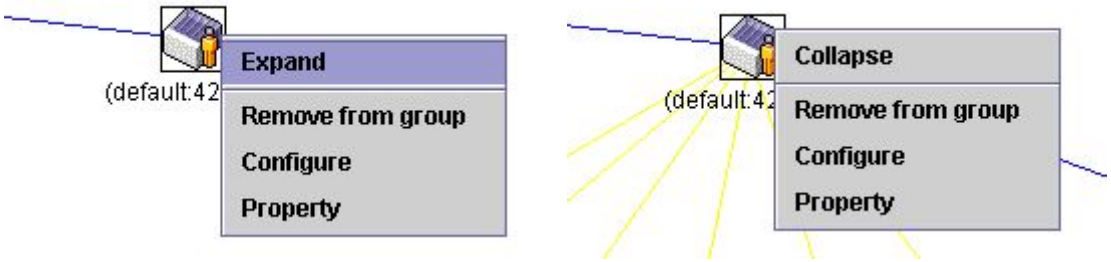


Figure 2 - 57. Right-Clicking a Member icon

The following options may appear for the user to configure:

- **Collapse** – To collapse the group that will be represented by a single icon.
- **Expand** – To expand the SIM group, in detail.
- **Remove from group** – Remove a member from a group.
- **Configure** – Launch the web management to configure the Switch.
- **Property** – To pop up a window to display the device information.

Candidate Switch Icon

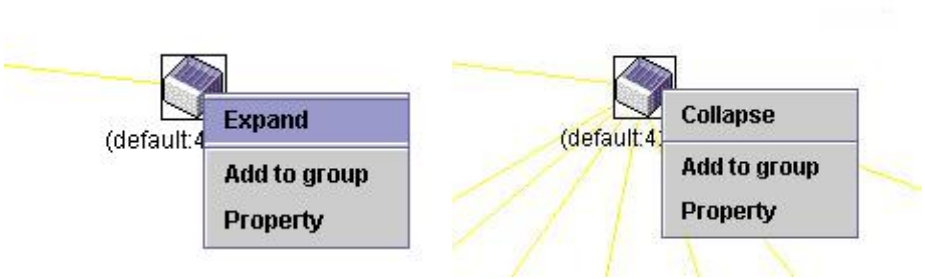


Figure 2 - 58. Right-Clicking a Candidate icon

The following options may appear for the user to configure:

- **Collapse** – To collapse the group that will be represented by a single icon.
- **Expand** – To expand the SIM group, in detail.
- **Add to group** – Add a candidate to a group. Clicking this option will reveal the following dialog box for the user to enter a password for authentication from the Candidate Switch before being added to the SIM group. Click **OK** to enter the password or **Cancel** to exit the dialog box.

Figure 2 - 59. Input password dialog box

- **Property** – To pop up a window to display the device information.

Menu Bar

The **Single IP Management** window contains a menu bar for device configurations, as seen below.

Figure 2 - 60. Menu Bar of the Topology View

The five menus on the menu bar are as follows.

File

- **Print Setup** – Will view the image to be printed.
- **Print Topology** – Will print the topology map.
- **Preference** – Will set display properties, such as polling interval, and the views to open at SIM startup.

Group

- **Add to group** – Add a candidate to a group. Clicking this option will reveal the following dialog box for the user to enter a password for authentication from the Candidate Switch before being added to the SIM group. Click **OK** to enter the password or **Cancel** to exit the dialog box.

Figure 2 - 61. Input password dialog box

- **Remove from Group** – Remove an MS from the group.

Device

- **Configure** – Will open the Web manager for the specific device.

View

- **Refresh** – Update the views with the latest status.
- **Topology** – Display the Topology view.

Help

- **About** – Will display the SIM information, including the current SIM version.

Firmware Upgrade

The Commander Switch may be used for firmware upgrades of member switches. Member Switches will be listed in the table and will be specified by Port (port on the CS where the MS resides), MAC Address, Model Name and Version. To specify a certain Switch for firmware download, click its corresponding check box under the Port heading. To update the firmware, enter the Server IP Address where the firmware resides and enter the Path/Filename of the firmware. Click **Download** to initiate the file transfer.

To view the following window, click **Configuration** > **Single IP Management > Firmware Upgrade**:

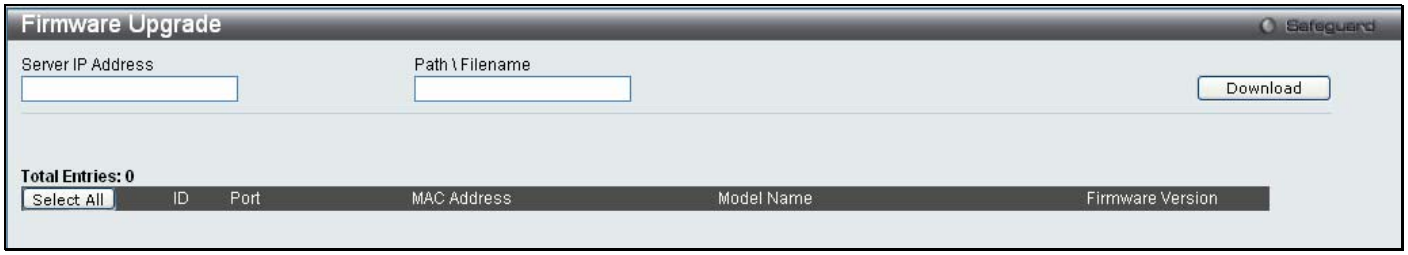


Figure 2 - 62. Firmware Upgrade window for Single IP Management

Configuration File Backup/Restore

The Commander Switch can instruct configuration file backup and restore to the Member Switch using a TFTP server. Member Switches will be listed in the table and will be specified by Port (port on the CS where the MS resides), MAC Address, Model Name and Version. To specify a certain Switch for upgrading configuration files, click its corresponding radio button under the Port heading. To update the configuration file, enter the Server IP Address where the file resides and enter the Path/Filename of the configuration file. Click **Restore** to initiate the file transfer from a TFTP server to the Switch. Click **Backup** to backup the configuration file to a TFTP server.

To view the following window, click **Configuration** > **Single IP Management > Configuration File Backup/Restore**:

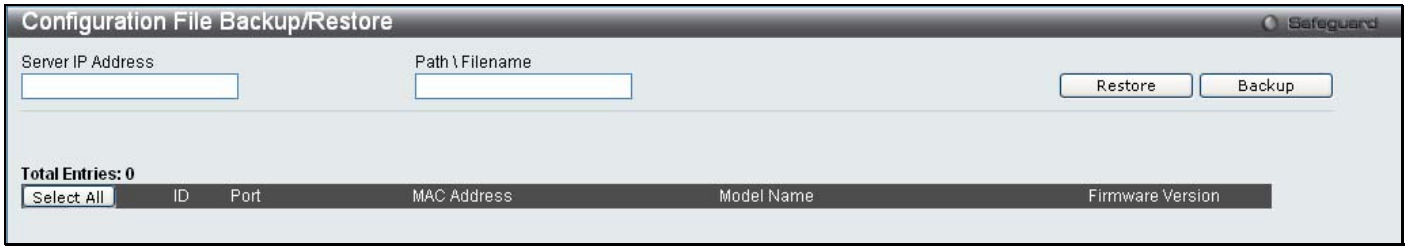


Figure 2 - 63. Configuration File Backup/Restore window for Single IP Management

Upload Log File

The Commander Switch can order a log file from a member switch sent to a server. Provide the Server IP address for storing the log and the log file path and filename on the member switch. Click **Upload** to send the log file to a TFTP server.

To view the following window, click **Configuration** > **Single IP Management > Upload Log File**:

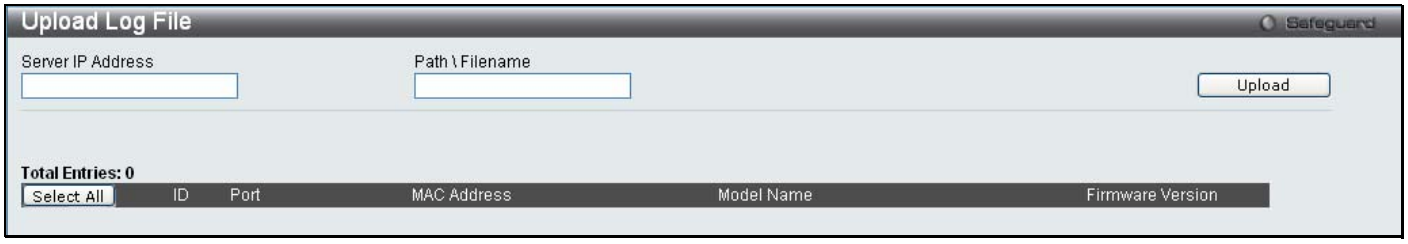


Figure 2 - 64. Upload Log File window for Single IP Management

Section 3

Layer 2 Features

Jumbo Frame
Egress Filter Settings
802.1Q VLAN
802.1V Protocol VLAN
MAC Based VLAN Settings
GVRP Settings
PVID Auto Assign Settings
Trunking
VLAN Trunk Settings
LACP Port Settings
Traffic Segmentation
IGMP Snooping
MLD Snooping Settings
Port Mirroring
Loopback Detection Settings
Spanning Tree
Forwarding and Filtering

The following section will aid the user in configuring security functions for the Switch. The Switch includes various functions for VLAN, Trunking, IGMP Snooping, MLD Snooping, Spanning Tree, and Forwarding & Filtering, all discussed in detail.

Jumbo Frame

The Switch supports jumbo frames. Jumbo frames are Ethernet frames with more than 1,500 bytes of payload. The Switch supports jumbo frames with a maximum frame size of 1536 bytes.

To view the following window, click **Layer 2 Features** > **Jumbo Frame**:

Figure 3 - 1. Jumbo Frame window

Parameter	Description
Jumbo Frame	This field will enable or disable the Jumbo Frame function on the Switch. The default is Disabled. The maximum frame size is 1536 bytes.

To enable or disable Jumbo Frame, use the radio button and click **Apply**.

Egress Filter Settings

Users can configure an egress filter on specific ports for unknown unicast and unregistered multicast packets.

The Switch drops all unknown unicast/multicast packets on egress ports when it detects unknown unicast/multicast packets for egress ports. Therefore, a user can select which port is permitted or not permitted to receive unknown unicast/multicast packets.

To view the following window, click **Layer 2 Features > Egress Filter Settings**:

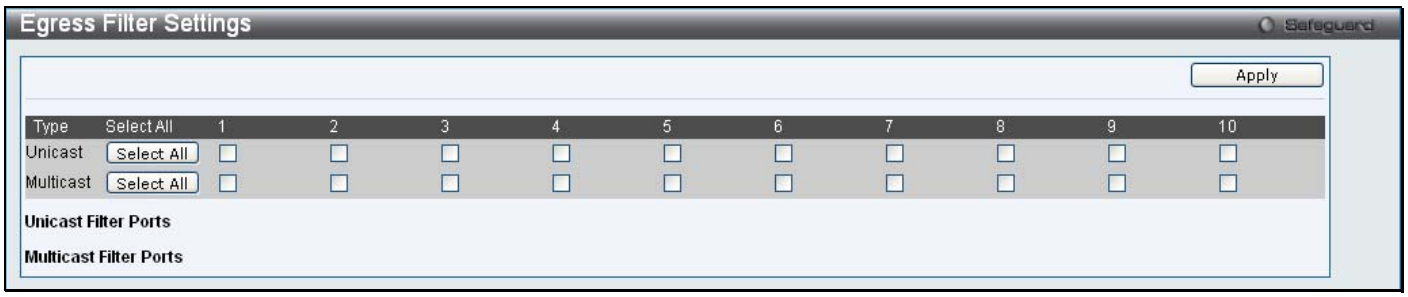


Figure 3 - 2. Egress Filter Settings window

The following fields can then be set:

Parameter	Description
Unicast	Select ports to filter unknown unicast packets. These packets will not be forwarded to those ports. Unselected ports will not filter unknown unicast packets and the packets may be forwarded to those ports.
Multicast	Select ports to filter unregistered multicast packets. These packets will not be forwarded to those ports. Unselected ports will not filter unregistered multicast packets and the packets may be forwarded to those ports.

Click **Apply** to implement changes made.

802.1Q VLAN

Understanding IEEE 802.1p Priority

Priority tagging is a function defined by the IEEE 802.1p standard designed to provide a means of managing traffic on a network where many different types of data may be transmitted simultaneously. It is intended to alleviate problems associated with the delivery of time critical data over congested networks. The quality of applications that are dependent on such time critical data, such as video conferencing, can be severely and adversely affected by even very small delays in transmission.

Network devices that are in compliance with the IEEE 802.1p standard have the ability to recognize the priority level of data packets. These devices can also assign a priority label or tag to packets. Compliant devices can also strip priority tags from packets. This priority tag determines the packet's degree of expeditiousness and determines the queue to which it will be assigned.

Priority tags are given values from 0 to 7 with 0 being assigned to the lowest priority data and 7 assigned to the highest. The highest priority tag 7 is generally only used for data associated with video or audio applications, which are sensitive to even slight delays, or for data from specified end users whose data transmissions warrant special consideration.

The Switch allows you to further tailor how priority tagged data packets are handled on your network. Using queues to manage priority tagged data allows you to specify its relative priority to suit the needs of your network. There may be circumstances where it would be advantageous to group two or more differently tagged packets into the same queue. Generally, however, it is recommended that the highest priority queue, Queue 7, be reserved for data packets with a priority value of 7. Packets that have not been given any priority value are placed in Queue 0 and thus given the lowest priority for delivery.

Strict mode and weighted round robin system are employed on the Switch to determine the rate at which the queues are emptied of packets. The ratio used for clearing the queues is 4:1. This means that the highest priority queue, Queue 7, will clear 4 packets for every 1 packet cleared from Queue 0.

Remember, the priority queue settings on the Switch are for all ports, and all devices connected to the Switch will be affected. This priority queuing system will be especially beneficial if your network employs switches with the capability of assigning priority tags.

VLAN Description

A Virtual Local Area Network (VLAN) is a network topology configured according to a logical scheme rather than the physical layout. VLANs can be used to combine any collection of LAN segments into an autonomous user group that appears as a single LAN. VLANs also logically segment the network into different broadcast domains so that packets are forwarded only between ports within the VLAN. Typically, a VLAN corresponds to a particular subnet, although not necessarily.

VLANs can enhance performance by conserving bandwidth, and improve security by limiting traffic to specific domains.

A VLAN is a collection of end nodes grouped by logic instead of physical location. End nodes that frequently communicate with each other are assigned to the same VLAN, regardless of where they are physically on the network. Logically, a VLAN can be equated to a broadcast domain, because broadcast packets are forwarded to only members of the VLAN on which the broadcast was initiated.

Notes about VLANs on the Switch

- No matter what basis is used to uniquely identify end nodes and assign these nodes VLAN membership, packets cannot cross VLANs without a network device performing a routing function between the VLANs.
- The Switch supports IEEE 802.1Q VLANs. The port untagging function can be used to remove the 802.1Q tag from packet headers to maintain compatibility with devices that are tag-unaware.
- The Switch's default is to assign all ports to a single 802.1Q VLAN named "default."
- The "default" VLAN has a VID = 1.
- The member ports of Port-based VLANs may overlap, if desired.

IEEE 802.1Q VLANs

Some relevant terms:

- **Tagging** – The act of putting 802.1Q VLAN information into the header of a packet.
- **Untagging** – The act of stripping 802.1Q VLAN information out of the packet header.
- **Ingress port** – A port on a switch where packets are flowing into the Switch and VLAN decisions must be made.
- **Egress port** – A port on a switch where packets are flowing out of the Switch, either to another switch or to an end station, and tagging decisions must be made.

IEEE 802.1Q (tagged) VLANs are implemented on the Switch. 802.1Q VLANs require tagging, which enables them to span the entire network (assuming all switches on the network are IEEE 802.1Q-compliant).

VLANs allow a network to be segmented in order to reduce the size of broadcast domains. All packets entering a VLAN will only be forwarded to the stations (over IEEE 802.1Q enabled switches) that are members of that VLAN, and this includes broadcast, multicast and unicast packets from unknown sources.

VLANs can also provide a level of security to your network. IEEE 802.1Q VLANs will only deliver packets between stations that are members of the VLAN.

Any port can be configured as either tagging or untagging. The untagging feature of IEEE 802.1Q VLANs allows VLANs to work with legacy switches that don't recognize VLAN tags in packet headers. The tagging feature allows VLANs to span multiple 802.1Q-compliant switches through a single physical connection and allows Spanning Tree to be enabled on all ports and work normally.

The IEEE 802.1Q standard restricts the forwarding of untagged packets to the VLAN the receiving port is a member of.

The main characteristics of IEEE 802.1Q are as follows:

- Assigns packets to VLANs by filtering.
- Assumes the presence of a single global spanning tree.
- Uses an explicit tagging scheme with one-level tagging.
- 802.1Q VLAN Packet Forwarding
- Packet forwarding decisions are made based upon the following three types of rules:
- Ingress rules – rules relevant to the classification of received frames belonging to a VLAN.

- Forwarding rules between ports – decides whether to filter or forward the packet.
- Egress rules – determines if the packet must be sent tagged or untagged.

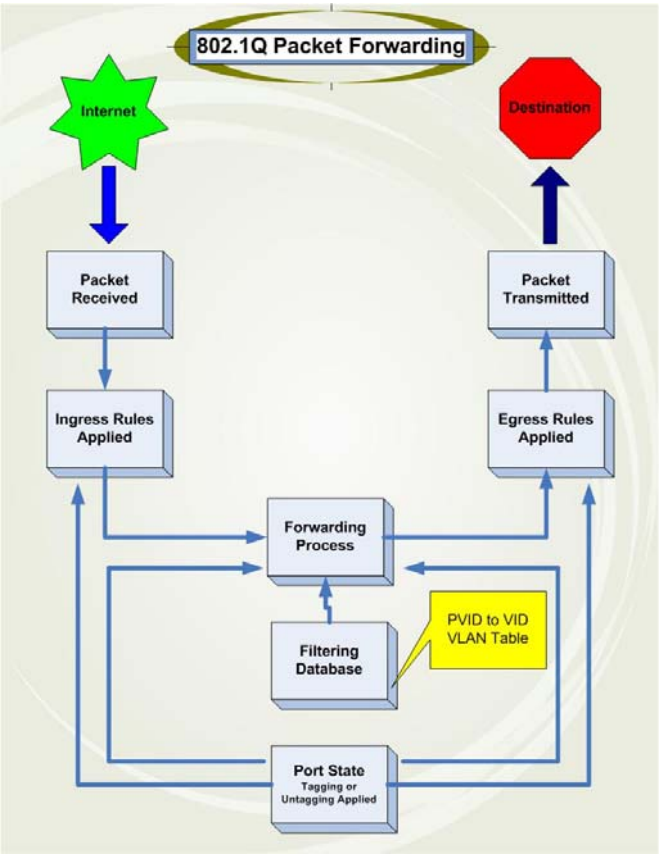


Figure 3 - 3. IEEE 802.1Q Packet Forwarding

802.1Q VLAN Tags

The figure below shows the 802.1Q VLAN tag. There are four additional octets inserted after the source MAC address. Their presence is indicated by a value of 0x8100 in the EtherType field. When a packet's EtherType field is equal to 0x8100, the packet carries the IEEE 802.1Q/802.1p tag. The tag is contained in the following two octets and consists of 3 bits of user priority, 1 bit of Canonical Format Identifier (CFI – used for encapsulating Token Ring packets so they can be carried across Ethernet backbones), and 12 bits of VLAN ID (VID). The 3 bits of user priority are used by 802.1p. The VID is the VLAN identifier and is used by the 802.1Q standard. Because the VID is 12 bits long, 4094 unique VLANs can be identified.

The tag is inserted into the packet header making the entire packet longer by 4 octets. All of the information originally contained in the packet is retained.

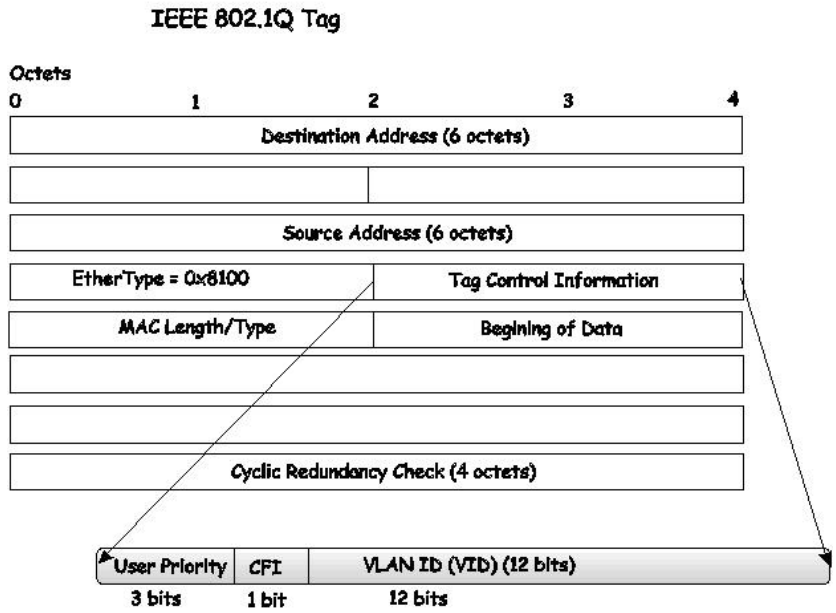


Figure 3 - 4. IEEE 802.1Q Tag

The EtherType and VLAN ID are inserted after the MAC source address, but before the original EtherType/Length or Logical Link Control. Because the packet is now a bit longer than it was originally, the Cyclic Redundancy Check (CRC) must be recalculated.

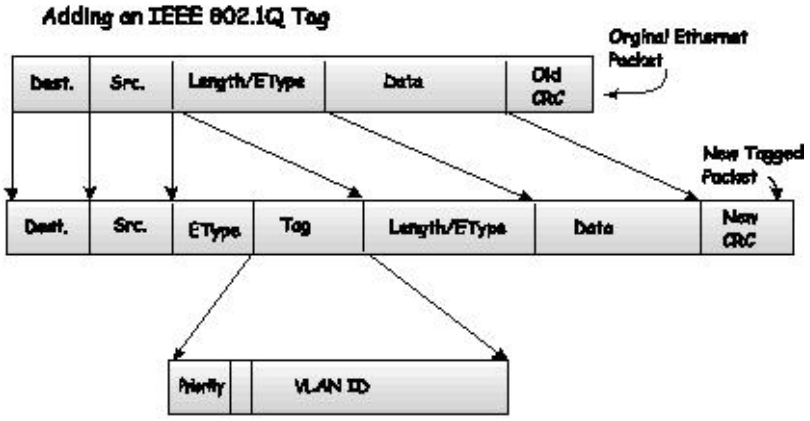


Figure 3 - 5. Adding an IEEE 802.1Q Tag

Port VLAN ID

Packets that are tagged (are carrying the 802.1Q VID information) can be transmitted from one 802.1Q compliant network device to another with the VLAN information intact. This allows 802.1Q VLANs to span network devices (and indeed, the entire network, if all network devices are 802.1Q compliant).

Unfortunately, not all network devices are 802.1Q compliant. These devices are referred to as tag-unaware. 802.1Q devices are referred to as tag-aware.

Prior to the adoption of 802.1Q VLANs, port-based and MAC-based VLANs were in common use. These VLANs relied upon a Port VLAN ID (PVID) to forward packets. A packet received on a given port would be assigned that port's PVID and then be forwarded to the port that corresponded to the packet's destination address (found in the Switch's forwarding table). If the PVID of the port that received the packet is different from the PVID of the port that is to transmit the packet, the Switch will drop the packet.

Within the Switch, different PVIDs mean different VLANs (remember that two VLANs cannot communicate without an external router). So, VLAN identification based upon the PVIDs cannot create VLANs that extend outside a given switch (or switch stack).

Every physical port on a switch has a PVID. 802.1Q ports are also assigned a PVID, for use within the Switch. If no VLANs are defined on the Switch, all ports are then assigned to a default VLAN with a PVID equal to 1. Untagged packets are assigned the PVID of the port on which they were received. Forwarding decisions are based upon this PVID, in so far as VLANs are concerned.

Tagged packets are forwarded according to the VID contained within the tag. Tagged packets are also assigned a PVID, but the PVID is not used to make packet-forwarding decisions, the VID is.

Tag-aware switches must keep a table to relate PVIDs within the Switch to VIDs on the network. The Switch will compare the VID of a packet to be transmitted to the VID of the port that is to transmit the packet. If the two VIDs are different, the Switch will drop the packet. Because of the existence of the PVID for untagged packets and the VID for tagged packets, tag-aware and tag-unaware network devices can coexist on the same network.

A switch port can have only one PVID, but can have as many VIDs as the Switch has memory in its VLAN table to store them.

Because some devices on a network may be tag-unaware, a decision must be made at each port on a tag-aware device before packets are transmitted – should the packet to be transmitted have a tag or not? If the transmitting port is connected to a tag-unaware device, the packet should be untagged. If the transmitting port is connected to a tag-aware device, the packet should be tagged.

Tagging and Untagging

Every port on an 802.1Q compliant switch can be configured as tagging or untagging.

Ports with tagging enabled will put the VID number, priority and other VLAN information into the header of all packets that flow into and out of it. If a packet has previously been tagged, the port will not alter the packet, thus keeping the VLAN information intact. Other 802.1Q compliant devices on the network to make packet-forwarding decisions can then use the VLAN information in the tag.

Ports with untagging enabled will strip the 802.1Q tag from all packets that flow into and out of those ports. If the packet doesn't have an 802.1Q VLAN tag, the port will not alter the packet. Thus, all packets received by and forwarded by an untagging port will have no 802.1Q VLAN information. (Remember that the PVID is only used internally within the Switch). Untagging is used to send packets from an 802.1Q-compliant network device to a non-compliant network device.

Ingress Filtering

A port on a switch where packets are flowing into the Switch and VLAN decisions must be made is referred to as an ingress port. If ingress filtering is enabled for a port, the Switch will examine the VLAN information in the packet header (if present) and decide whether or not to forward the packet.

If the packet is tagged with VLAN information, the ingress port will first determine if the ingress port itself is a member of the tagged VLAN. If it is not, the packet will be dropped. If the ingress port is a member of the 802.1Q VLAN, the Switch then determines if the destination port is a member of the 802.1Q VLAN. If it is not, the packet is dropped. If the destination port is a member of the 802.1Q VLAN, the packet is forwarded and the destination port transmits it to its attached network segment.

If the packet is not tagged with VLAN information, the ingress port will tag the packet with its own PVID as a VID (if the port is a tagging port). The switch then determines if the destination port is a member of the same VLAN (has the same VID) as the ingress port. If it does not, the packet is dropped. If it has the same VID, the packet is forwarded and the destination port transmits it on its attached network segment.

This process is referred to as ingress filtering and is used to conserve bandwidth within the Switch by dropping packets that are not on the same VLAN as the ingress port at the point of reception. This eliminates the subsequent processing of packets that will just be dropped by the destination port.

Default VLANs

The Switch initially configures one VLAN, VID = 1, called "default." The factory default setting assigns all ports on the Switch to the "default." As new VLANs are configured in Port-based mode, their respective member ports are removed from the "default."

Packets cannot cross VLANs. If a member of one VLAN wants to connect to another VLAN, the link must be through an external router.

NOTE: If no VLANs are configured on the Switch, then all packets will be forwarded to any destination port. Packets with unknown source addresses will be flooded to all ports. Broadcast and multicast packets will also be flooded to all ports.

An example is presented below:

VLAN Name	VID	Switch Ports
System (default)	1	5, 6, 7
Engineering	2	9, 10
Sales	5	1, 2, 3, 4

Table 3 - 1. VLAN Example – Assigned Ports

Port-based VLANs

Port-based VLANs limit traffic that flows into and out of switch ports. Thus, all devices connected to a port are members of the VLAN(s) the port belongs to, whether there is a single computer directly connected to a switch, or an entire department.

On port-based VLANs, NICs do not need to be able to identify 802.1Q tags in packet headers. NICs send and receive normal Ethernet packets. If the packet's destination lies on the same segment, communications take place using normal Ethernet protocols. Even though this is always the case, when the destination for a packet lies on another switch port, VLAN considerations come into play to decide if the packet gets dropped by the Switch or delivered.

VLAN Segmentation

Take for example a packet that is transmitted by a machine on Port 1 that is a member of VLAN 2. If the destination lies on another port (found through a normal forwarding table lookup), the Switch then looks to see if the other port (Port 10) is a member of VLAN 2 (and can therefore receive VLAN 2 packets). If Port 10 is not a member of VLAN 2, then the packet will be dropped by the Switch and will not reach its destination. If Port 10 is a member of VLAN 2, the packet will go through. This selective forwarding feature based on VLAN criteria is how VLANs segment networks. The key point being that Port 1 will only transmit on VLAN 2.

VLAN and Trunk Groups

The members of a trunk group have the same VLAN setting. Any VLAN setting on the members of a trunk group will apply to the other member ports.

NOTE: In order to use VLAN segmentation in conjunction with port trunk groups, first set the port trunk group(s), and then configure the VLAN settings. To change the port trunk grouping with VLANs already in place it is unnecessary to reconfigure the VLAN settings after changing the port trunk group settings. VLAN settings will automatically change in conjunction with the change of the port trunk group settings.

To view the following window, click **L2 Features** > **802.1Q VLAN**:

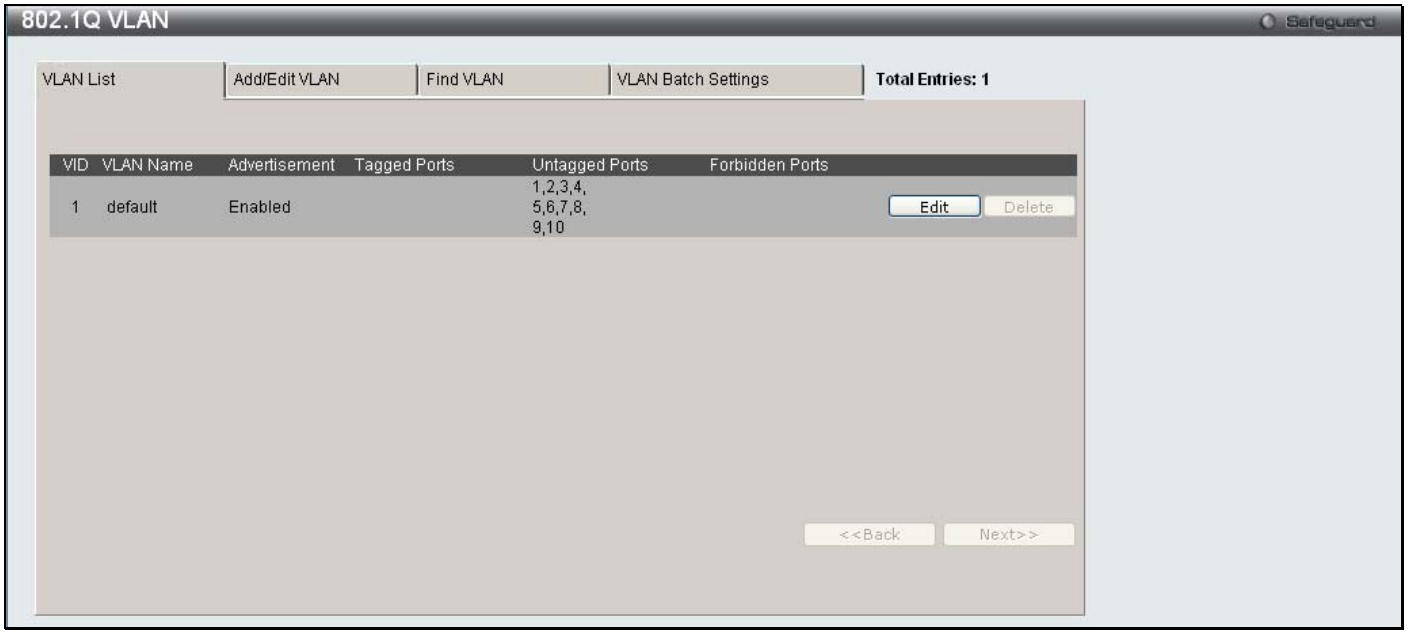


Figure 3 - 6. VLAN List tab of the 802.1Q VLAN window

The **VLAN List** tab lists all previously configured VLANs by VLAN ID and VLAN Name. To delete an existing 802.1Q VLAN, click the corresponding **Delete** button.

To create a new 802.1Q VLAN or modify an existing 802.1Q VLAN, click the **Add/Edit VLAN** tab. A new tab will appear, as shown below, to configure the port settings and to assign a unique name and number to the new VLAN. See the table on the next page for a description of the parameters in the new window.

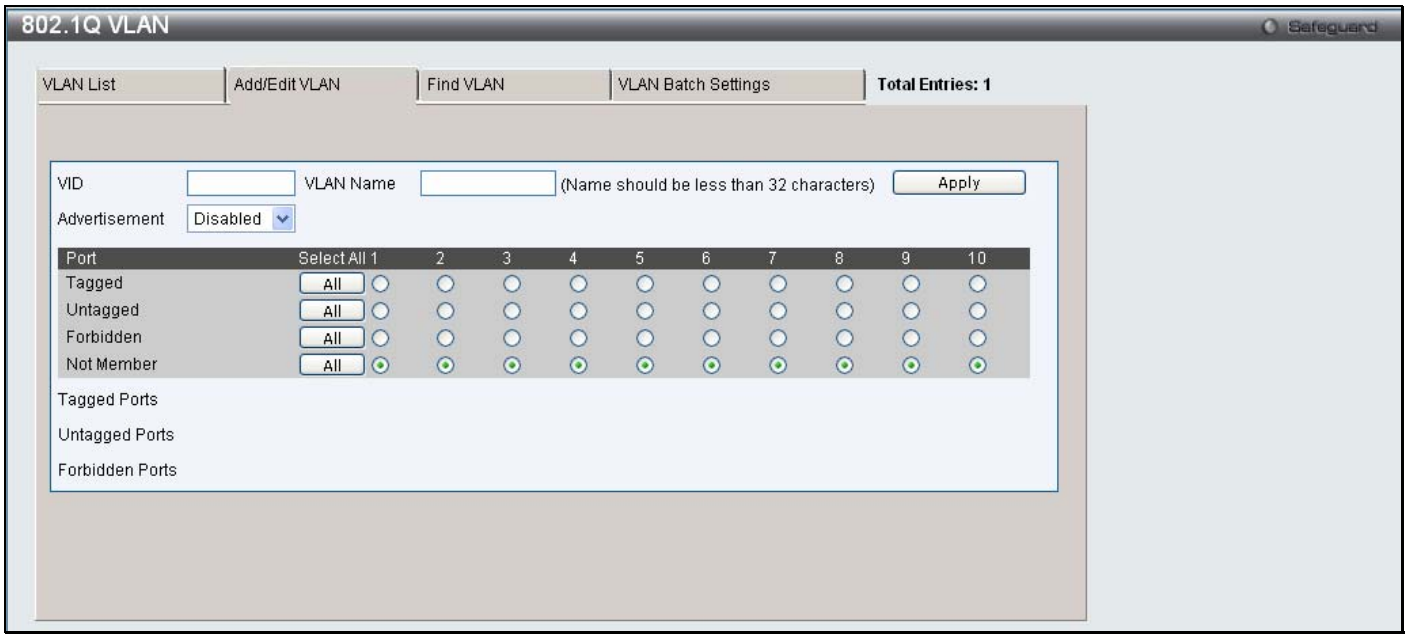


Figure 3 - 7. Add/Edit VLAN tab of the 802.1Q VLAN window

The following fields can then be set in the **Add/Edit VLAN** tab:

Parameter	Description
VID (VLAN ID)	Allows the entry of a VLAN ID or displays the VLAN ID of an existing VLAN in the **Add/Edit VLAN** tab. VLANs can be identified by either the VID or the VLAN name.
VLAN Name	Allows the entry of a name for the new VLAN or for editing the VLAN name in the **Add/Edit VLAN** tab.
Advertisement	Enabling this function will allow the Switch to send out GVRP packets to outside sources, notifying that they may join the existing VLAN.
Port	Shows all ports of the Switch for the onfiguration option.
Tagged	Specifies the port as 802.1Q tagging. Clicking the radio button will designate the port as tagged.
Untagged	Specifies the port as 802.1Q untagged. Clicking the radio button will designate the port as untagged.
Forbidden	Click the radio button to specify the port as not being a member of the VLAN and that the port is forbidden from becoming a member of the VLAN dynamically.
Not Member	Click the radio button to allow an individual port to be specified as a non-VLAN member.

Click **Apply** to implement changes made.

To search for a VLAN, click the **Find VLAN** tab. A new tab will appear, as shown below. Enter the VLAN ID number in the field offered and then click the **Find** button. You will be redirected to the **VLAN List** tab. See the table on the next page for a description of the parameters in the new window.

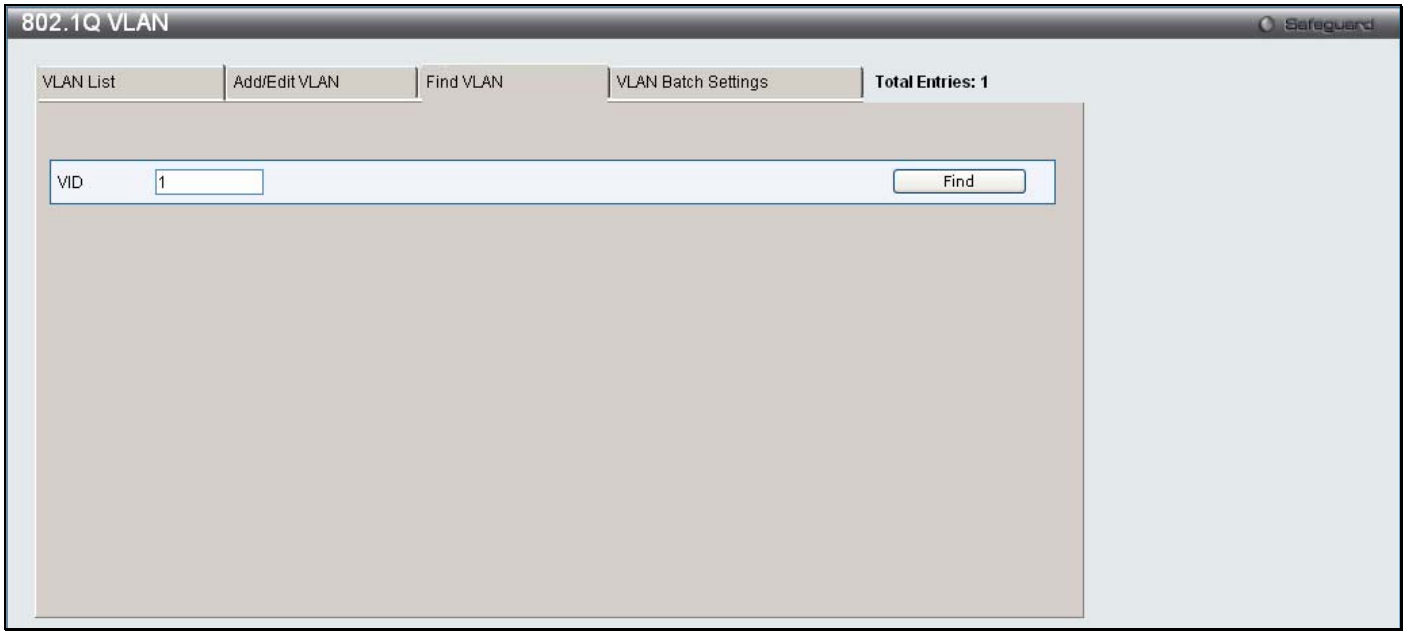


Figure 3 - 8. Find VLAN tab of the 802.1Q VLAN window

To create a VLAN Batch entry click the **VLAN Batch Settings** tab, as shown below.

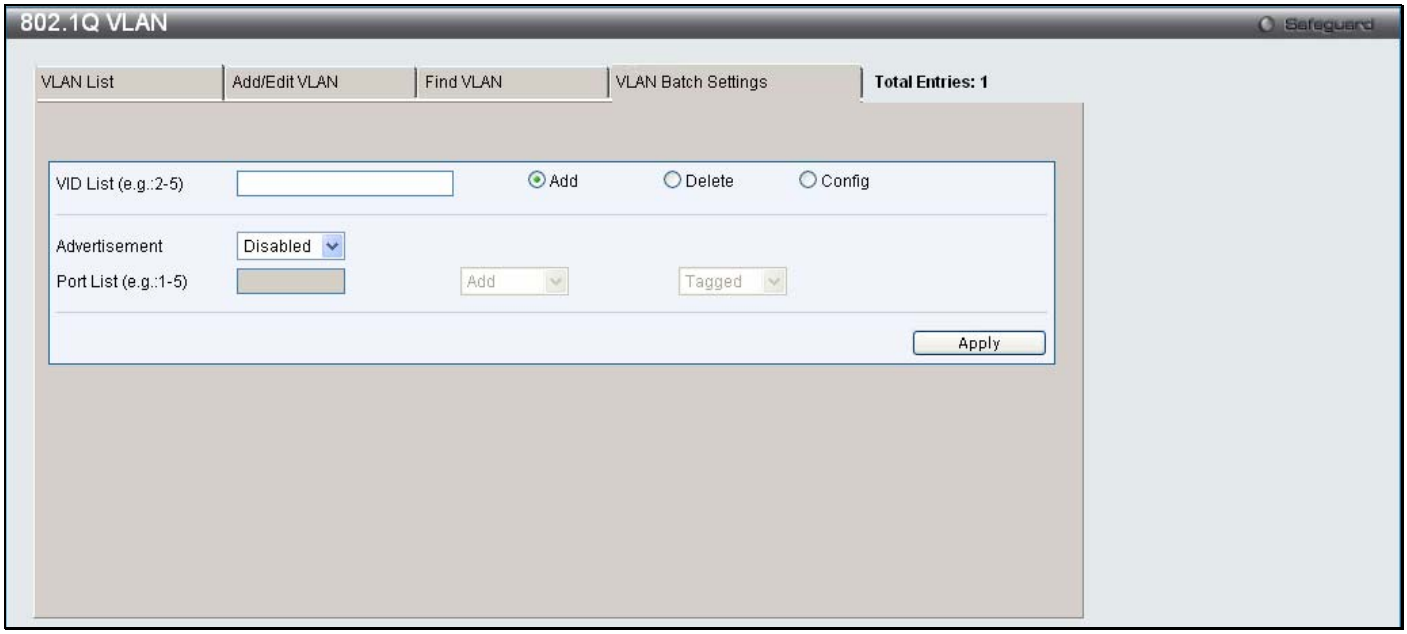


Figure 3 - 9. VLAN Batch Settings tab of the 802.1Q VLAN window

The following fields can be set in the **VLAN Batch Settings** windows:

Parameter	Description
VID List (e.g 2-5)	Enter a VLAN ID List that can be added, deleted or configured.
Advertisement	Enabling this function will allow the Switch to send out GVRP packets to outside sources, notifying that they may join the existing VLAN.
Port List (e.g. 1-5)	Allows an individual port list to be added or deleted as a member of the VLAN.
Tagged	Specifies the port as 802.1Q tagged. Use the drop-down menu to designate the port as tagged.

Untagged	Specifies the port as 802.1Q untagged. Use the drop-down menu to designate the port as untagged.
Forbidden	Specifies the port as not being a member of the VLAN and that the port is forbidden from becoming a member of the VLAN dynamically. Use the drop-down menu to designate the port as forbidden.

Click **Apply** to implement changes made.

NOTE: The Switch supports up to 4k static VLAN entries.

802.1v Protocol VLAN

The **802.1v Protocol VLAN** folder contains two windows: **802.1v Protocol Group Settings** and **802.1v Protocol VLAN Settings**.

802.1v Protocol Group Settings

The user can create Protocol VLAN groups and add protocols to that group. The 802.1v Protocol VLAN Group Settings support multiple VLANs for each protocol and allows the user to configure the untagged ports of different protocols on the same physical port. For example, it allows the user to configure an 802.1Q and 802.1v untagged port on the same physical port. The lower half of the table displays any previously created groups.

To view the following window, click **L2 Features** > **802.1V Protocol VLAN** > **802.1v Protocol Group Settings**:

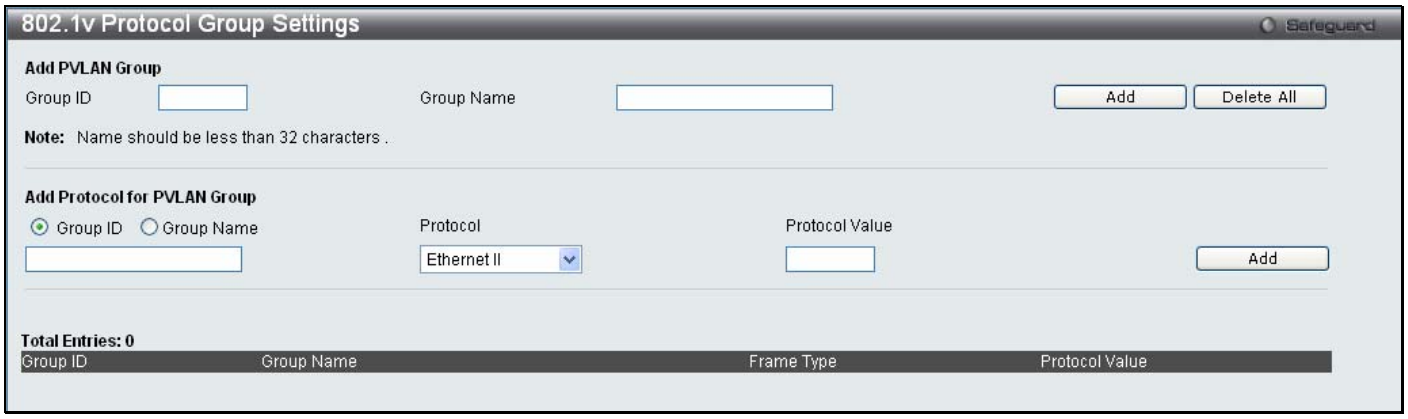


Figure 3 - 10. 802.1v Protocol Group Settings window

The following fields can be set:

Parameter	Description
Group ID	Select an ID number for the group, between *1* and *8.*
Group Name	This is used to identify the new Protocol VLAN group. Type an alphanumeric string of up to 32 characters.
Protocol	This function maps packets to protocol-defined VLANs by examining the type octet within the packet header to discover the type of protocol associated with it. Use the drop-down menu to toggle between *Ethernet II*, *IEEE802.3 LLC*, and *IEEE802.3 SNAP*.
Protocol Value	Enter a value for the Group. The protocol value is used to identify a protocol of the frame type specified. The form of the input is 0x0 to 0xffff. Depending on the frame type, the octet string will have one of the following values: For Ethernet II, this is a 16-bit (2-octet) hex value. For example, IPv4 is 800, IPv6 is 86dd, ARP is 806, etc. For IEEE802.3 SNAP, this is this is a 16-bit (2-octet) hex value. For IEEE802.3 LLC, this is the 2-octet IEEE 802.2 Link Service Access Point (LSAP) pair. The first octet is for Destination Service Access Point (DSAP) and the second octet is for Source.

Click **Add** to make a new entry and **Delete All** to remove an entry.

802.1v Protocol VLAN Settings

The user can configure Protocol VLAN settings. The lower half of the table displays any previously created settings.

To view the following window, click **L2 Features** > **802.1v Protocol VLAN** > **802.1v Protocol VLAN Settings**:

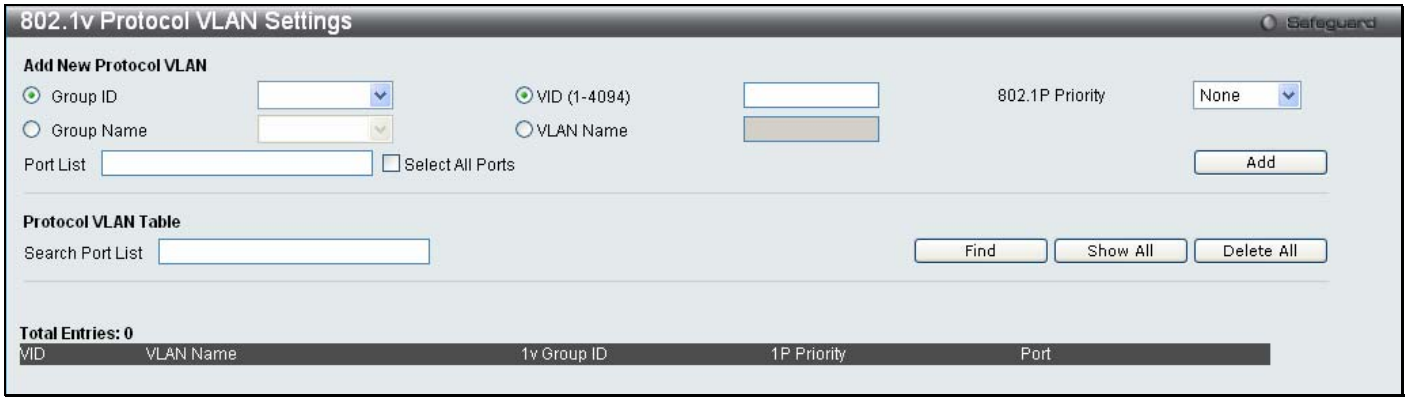


Figure 3 - 11. 802.1v Protocol VLAN Settings window

The following fields can be set:

Parameter	Description
Group ID	Highlight the corresponding RADIUS button to select a previously configured Group ID from the drop-down menu.
Group Name	Highlight the corresponding RADIUS button to select a previously configured Group Name from the drop-down menu.
VID (1-4094)	Highlight the RADIUS button to enter the VID. This is the VLAN ID that, along with the VLAN Name, identifies the VLAN the user wishes to create.
VLAN Name	Highlight the RADIUS button to enter a VLAN Name. This is the VLAN Name that, along with the VLAN ID, identifies the VLAN the user wishes to create.
802.1P Priority	This parameter is specified if you want to re-write the 802.1p default priority previously set in the Switch, which is used to determine the CoS queue to which packets are forwarded to. Once this field is specified, packets accepted by the Switch that match this priority are forwarded to the CoS queue specified previously by the user. Click the corresponding box if you want to set the 802.1p default priority of a packet to the value entered in the Priority (0-7) field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the QoS section of this manual.
Port List	Select the specified ports you wish to configure by entering the port number in this field, or tick the Select All Ports check box.
Search Port List	This function allows the user to search all previously configured port list settings and display them on the lower half of the table. To search for a port list enter the port number you wish to view and click **Find**. To display all previously configured port lists on the bottom half of the screen click the **Show All** button, to clear all previously configured lists click the **Delete All** button.

MAC Based VLAN Settings

Users can create new MAC-based VLAN entries and search, edit, and delete existing entries. When an entry is created for a port, the port will automatically become the untagged member port of the specificed VLAN. When a static MAC-based VLAN entry is created for a user, the traffic from this user will be able to be serviced under the specified VLAN regardless of the authentication function operating on this port.

To view the following window, click **L2 Features** > **MAC Based VLAN Settings**:

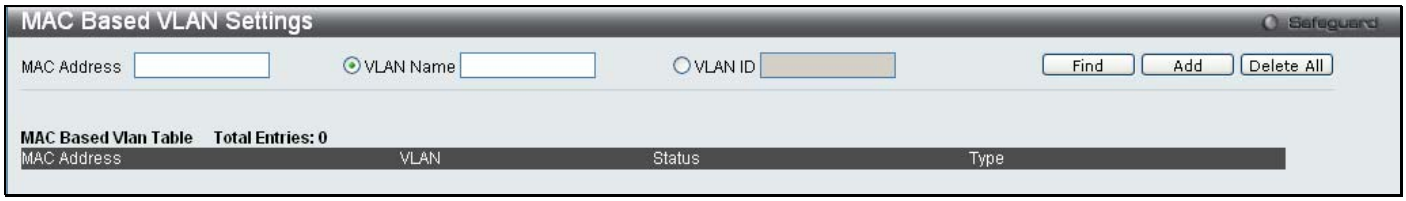


Figure 3 - 12. MAC Based VLAN Settings window

The following fields can be set:

Parameter	Description
MAC Address	Specify the MAC address to be reauthenticated by entering it into the MAC Address field.
VLAN Name	Enter the VLAN name of a previously configured VLAN.
VLAN ID	Click this button and enter the VLAN ID.

Click **Find**, **Add** or **Delete All** for changes to take affect.

GVRP Settings

Users can determine whether the Switch will share its VLAN configuration information with other GARP VLAN Registration Protocol (GVRP) enabled switches. In addition, Ingress Checking can be used to limit traffic by filtering incoming packets whose PVID does not match the PVID of the port. Results can be seen in the table under the configuration settings.

To view the following window, click **L2 Features** > **GVRP Settings**:

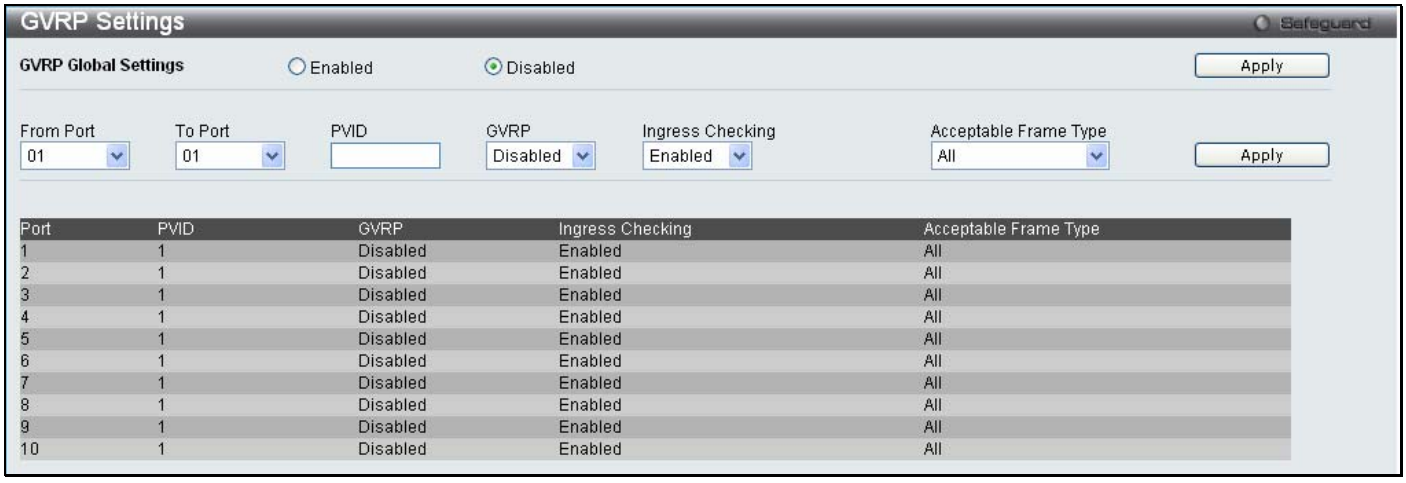


Figure 3 - 13. GVRP Settings window

Click **Apply** to implement changes made. See table below for description of parameters.

The following fields can be set:

Parameter	Description
From Port	This drop-down menu allows the selection of the beginning port for a range of ports that will be included in the Port-based VLAN.
To Port	This drop-down menu allows the selection of the ending port for a range of ports that will be included in the Port-based VLAN.
PVID	This field is used to manually assign a PVID to a VLAN. The Switch's default is to assign all ports to the default VLAN with a VID of 1.The PVID is used by the port to tag outgoing, untagged packets, and to make filtering decisions about incoming packets. If the port is specified to accept only tagged frames - as tagging, and an untagged packet is forwarded to the port for transmission, the port will add an 802.1Q tag using the PVID to write the VID in the tag. When the packet arrives at its destination, the receiving device will use the PVID to make VLAN forwarding decisions. If the port receives a packet, and Ingress filtering is *Enabled*, the port will compare the VID of the incoming packet to its PVID. If the two are unequal, the port will drop the packet. If the two are equal, the port will receive the packet.
GVRP	The GARP VLAN Registration Protocol (GVRP) enables the port to dynamically become a member of a VLAN. GVRP is *Disabled* by default.
Ingress Checking	This drop-down menu allows the user to enable the port to compare the VID tag of an incoming packet with the PVID number assigned to the port. If the two are different, the port filters (drops) the packet. *Disabled* disables ingress filtering. Ingress checking is *Enabled* by default.
Acceptable Frame Type	This field denotes the type of frame that will be accepted by the port. The user may choose between *Tagged Only*, which means only VLAN tagged frames will be accepted, and *All*, which mean both tagged and untagged frames will be accepted. *All* is enabled by default.

PVID Auto Assign Settings

Users can enable or disable PVID Auto Assign Status. The default setting is enabled.

To view the following window, click **L2 Features** > **PVID Auto Assign Settings**:

Figure 3 - 14. PVID Auto Assign Settings window

Click **Apply** to implement changes made. Please see the previous section for more information about PVIDs.

Trunking

Understanding Port Trunk Groups

Port trunk groups are used to combine a number of ports together to make a single high-bandwidth data pipeline. The Switch supports up to five port trunk groups with two to eight ports in each group. A potential bit rate of 8000 Mbps can be achieved.

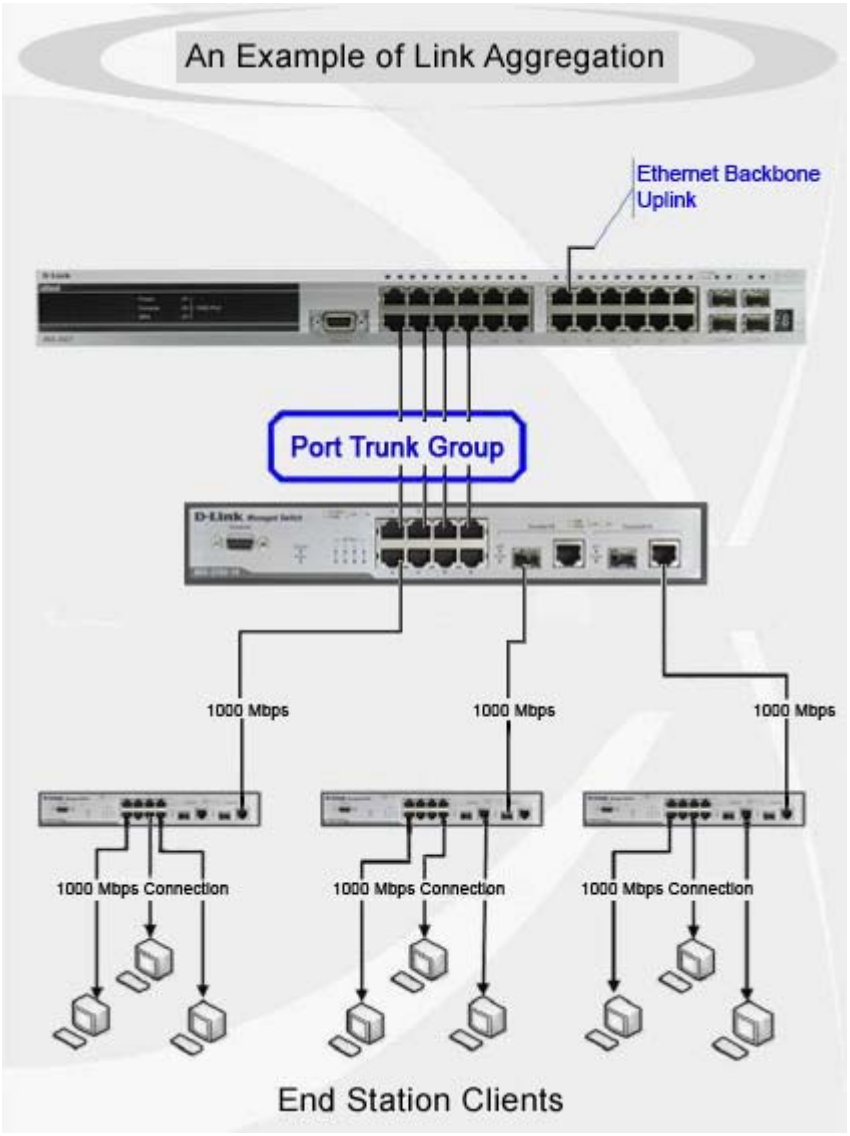


Figure 3 - 15. Example of Typical Port Trunk Group

The Switch treats all ports in a trunk group as a single port. Data transmitted to a specific host (destination address) will always be transmitted over the same port in a trunk group. This allows packets in a data stream to arrive in the same order they were sent.

NOTE: If any ports within the trunk group become disconnected, packets intended for the disconnected port will be load shared among the other linked ports of the link aggregation group.

Link aggregation allows several ports to be grouped together and to act as a single link. This gives a bandwidth that is a multiple of a single link's bandwidth.

Link aggregation is most commonly used to link a bandwidth intensive network device or devices, such as a server, to the backbone of a network.

The Switch allows the creation of up to five link aggregation groups, each group consisting of 2 to 8 links (ports). The (optional) Gigabit ports can only belong to a single link aggregation group. All of the ports in the group must be members of the same VLAN, and their STP status, static multicast, traffic control; traffic segmentation and 802.1p default priority configurations must be identical. Port locking, port mirroring and 802.1X must not be enabled on the trunk group. Further, the LACP aggregated links must all be of the same speed and should be configured as full duplex.

The Master Port of the group is to be configured by the user, and all configuration options, including the VLAN configuration that can be applied to the Master Port, are applied to the entire link aggregation group.

Load balancing is automatically applied to the ports in the aggregated group, and a link failure within the group causes the network traffic to be directed to the remaining links in the group.

The Spanning Tree Protocol will treat a link aggregation group as a single link, on the switch level. On the port level, the STP will use the port parameters of the Master Port in the calculation of port cost and in determining the state of the link aggregation group. If two redundant link aggregation groups are configured on the Switch, STP will block one entire group; in the same way STP will block a single port that has a redundant link.

To view the following window, click **L2 Features** > **Trunking**:

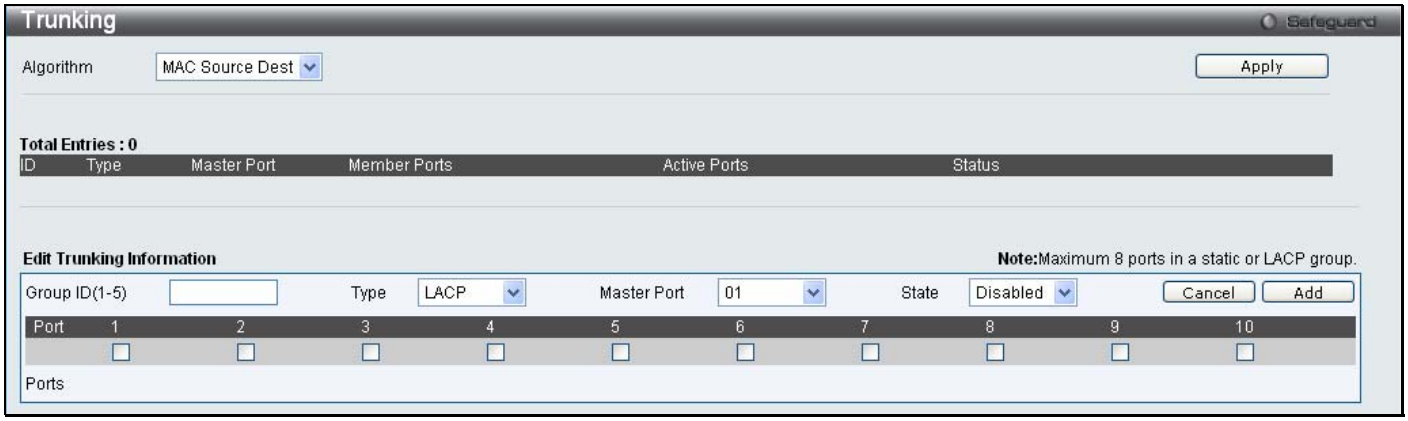


Figure 3 - 16. Trunking window

To configure port trunk groups, click the **Add** button. To modify an existing port trunk group, click the **Edit** button corresponding to the group. To delete a port trunk group, click the corresponding **Delete** button.

The user-changeable parameters are as follows:

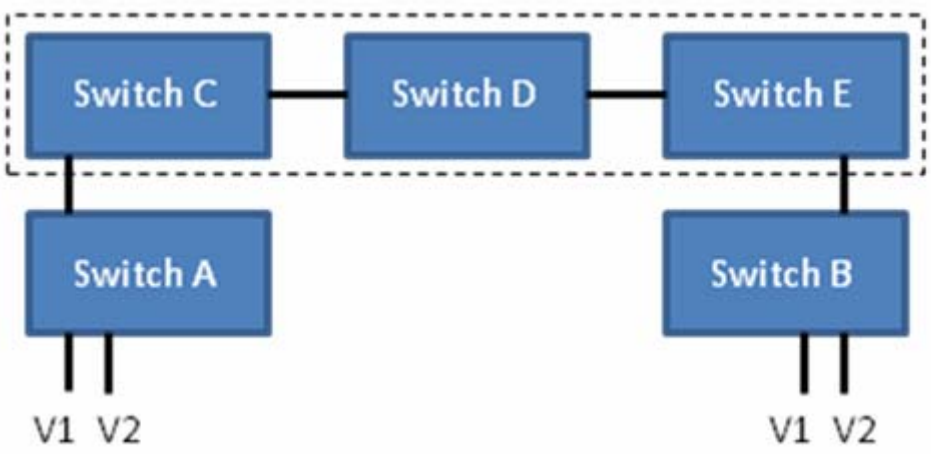
Parameter	Description
Algorithm	Toggle between *MAC Source Dest* and *IP Source Dest*.
Group ID (1-5)	Select an ID number for the group, between *1* and *5*.
Type	This pull-down menu allows users to select between *Static* and *LACP* (Link Aggregation Control Protocol). *LACP* allows for the automatic detection of links in a Port Trunking Group.
Master Port	Choose the Master Port for the trunk group using the pull-down menu.
State	Use the drop-down menu to toggle between *Enabled* and *Disabled*. This is used to turn a port trunking group on or off. This is useful for diagnostics, to quickly isolate a bandwidth intensive network device or to have an absolute backup aggregation group that is not under automatic control.
Member Ports	Choose the members of a trunked group. Up to eight ports per group can be assigned to a group.
Active Ports	Shows the ports that are currently forwarding packets.

After setting the previous parameters, click **Apply** to allow your changes to be implemented.

VLAN Trunk Settings

Enable VLAN on a port to allow frames belonging to unknown VLAN groups to pass through that port. This is useful if you want to set up VLAN groups on end devices without having to configure the same VLAN groups on intermediary devices.

Refer to the following figure for an illustrated example. Suppose you want to create VLAN groups 1 and 2 (V1 and V2) on devices A and B. Without a VLAN Trun**k**, you must first configure VLAN groups 1 and 2 on all intermediary switches C, D and E; otherwise they will drop frames with unknown VLAN group tags. However, with VLAN Trunk enabled on a port(s) in each intermediary switch, you only need to create VLAN groups in the end devices (A and B). C, D and E automatically allow frames with VLAN group tags 1 and 2 (VLAN groups that are unknown to those switches) to pass through their VLAN trunking port(s).



Users can combine a number of VLAN ports together to create VLAN trunks. To create VLAN Trunk Port settings on the Switch, select the ports to be configured, change the VLAN Trunk Global State to Enabled, and click **Apply**, the new settings will appear in the VLAN Trunk Settings table in the lower part of the window.

To view the following window, click **L2 Features** > **VLAN Trunk Settings**:

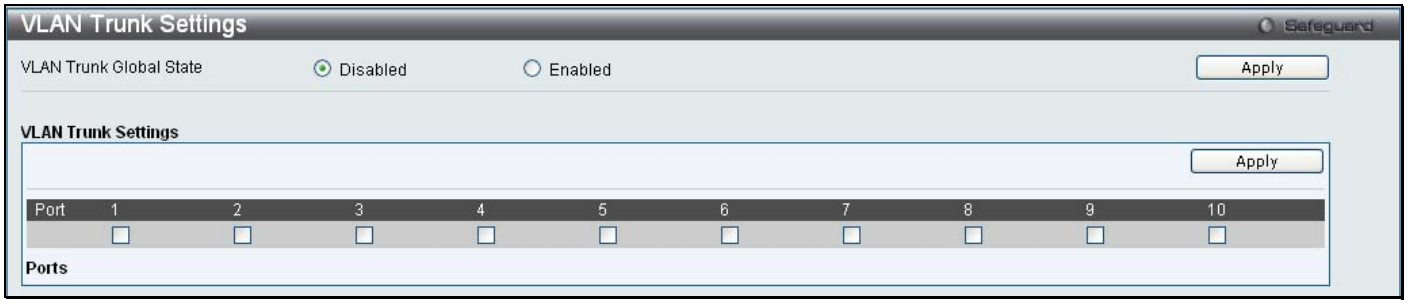


Figure 3 - 17. VLAN Trunk Settings window

The user-changeable parameters are as follows:

Parameter	Description
VLAN Trunk Global State	Enable or disable the VLAN trunking global state.
Ports	The ports to be configured.

LACP Port Settings

In conjunction with the **Trunking** window, users can create port trunking groups on the Switch. Using the following window, the user may set which ports will be active and passive in processing and sending LACP control frames.

To view the following window, click **L2 Features** > **LACP Port Settings**:

Figure 3 - 18. LACP Port Settings window

The user may set the following parameters:

Parameter	Description
From Port	The beginning port of a consecutive group of ports may be configured starting with the selected port.
To Port	The ending port of a consecutive group of ports may be configured ending with the selected port.
Mode	*Active* - Active LACP ports are capable of processing and sending LACP control frames. This allows LACP compliant devices to negotiate the aggregated link so the group may be changed dynamically as needs require. In order to utilize the ability to change an aggregated port group, that is, to add or subtract ports from the group, at least one of the participating devices must designate LACP ports as active. Both devices must support LACP. *Passive* - LACP ports that are designated as passive cannot initially send LACP control frames. In order to allow the linked port group to negotiate adjustments and make changes dynamically, one end of the connection must have "active" LACP ports (see above).

After setting the previous parameters, click **Apply** to allow your changes to be implemented.

Traffic Segmentation

Traffic segmentation is used to limit traffic flow from a single or group of ports, to a group of ports. This method of segmenting the flow of traffic is similar to using VLANs to limit traffic, but is more restrictive. It provides a method of directing traffic that does not increase the overhead of the Master switch CPU.

To view the following window, click **L2 Features** > **Traffic Segmentation**:

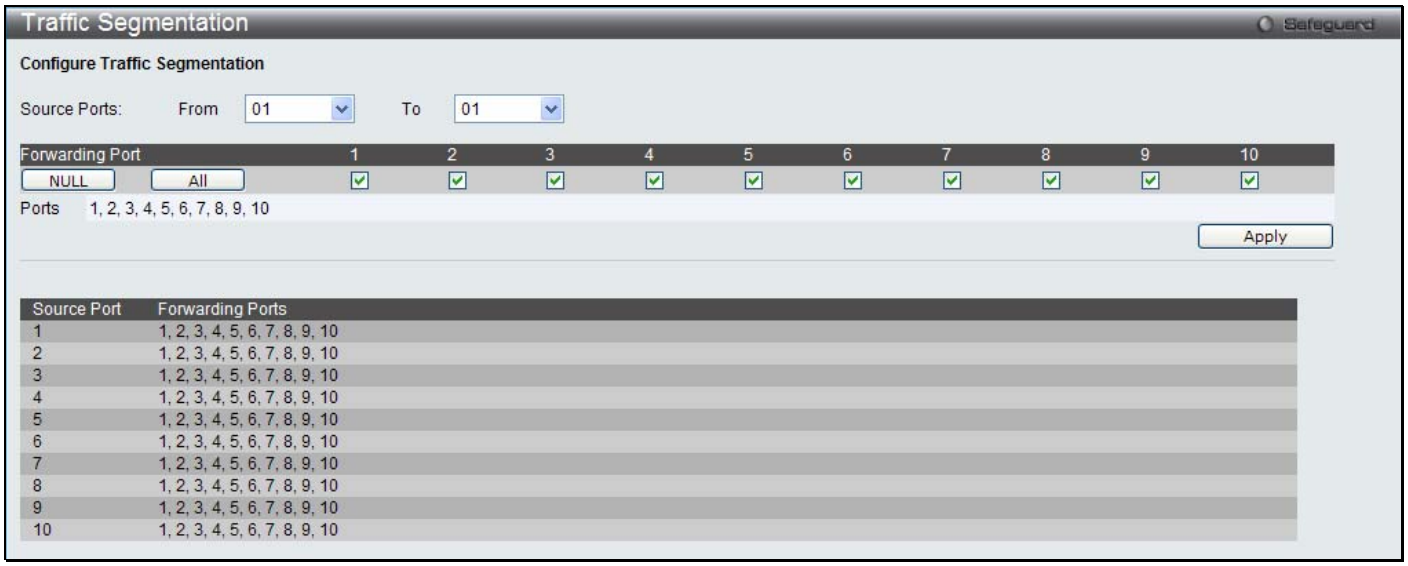


Figure 3 - 19. Traffic Segmentation window

To configure traffic segmentation on the Switch, first specify the Source Port(s) using the From and To drop-down menus at the top of the window. Next, specify which ports on the Switch are able to receive packets from the port(s) specified in the first step.

Clicking the **Apply** button will enter the combination of transmitting port(s) and allowed receiving ports into the Switch's Traffic Segmentation table.

IGMP Snooping

Internet Group Management Protocol (IGMP) snooping allows the Switch to recognize IGMP queries and reports sent between network stations or devices and an IGMP host. When enabled for IGMP snooping, the Switch can open or close a port to a specific device based on IGMP messages passing through the Switch.

IGMP Snooping Settings

In order to use IGMP Snooping it must first be enabled for the entire Switch under IGMP Global Settings at the top of the window. You may then fine-tune the settings for each VLAN by clicking the corresponding **Edit** button. When enabled for IGMP snooping, the Switch can open or close a port to a specific multicast group member based on IGMP messages sent from the device to the IGMP host or vice versa. The Switch monitors IGMP messages and discontinues forwarding multicast packets when there are no longer hosts requesting that they continue.

To view the following window, click **L2 Features** > **IGMP Snooping Settings**:

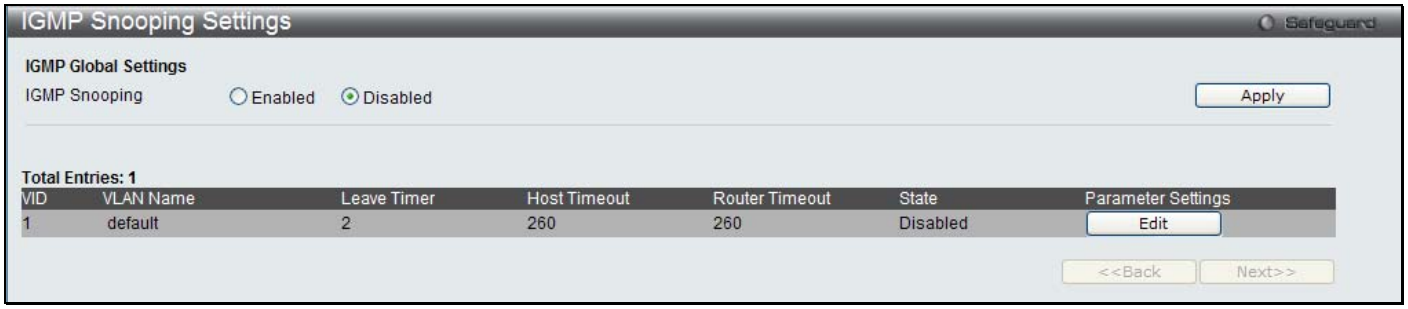


Figure 3 - 20. IGMP Snooping Settings window

The following parameters may be viewed or modified:

Parameter	Description
VID (VLAN ID)	This is the VLAN ID that, along with the VLAN Name, identifies the VLAN the user wishes to modify the IGMP Snooping Settings for.
VLAN Name	This is the VLAN Name that, along with the VLAN ID, identifies the VLAN the user wishes to modify the IGMP Snooping Settings for.
Leave Timer	This specifies the maximum amount of time in seconds between the Switch receiving a leave group message from a host, and the Switch issuing a group membership query. If no response to the membership query is received before the Leave Timer expires, the (multicast) forwarding entry for that host is deleted. The default setting is *2* seconds.
Host Timeout	This is the maximum amount of time in seconds allowed for a host to continue membership in a multicast group without the Switch receiving a host membership report. Default = *260*.
Router Timeout	This is the maximum amount of time in seconds a route is kept in the forwarding table without receiving a membership report. Default = *260*.
State	Select *Enabled* to implement IGMP Snooping. This field is *Disabled* by default.

Click **Apply** to implement the new settings.

Data Driven Learning Settings

The Switch allows you to implement data driven learning for IGMP snooping groups. If data-driven learning, also known as dynamic IP multicast learning, is enabled for a VLAN, when the Switch receives IP multicast traffic on the VLAN, an IGMP snooping group is created. Learning of an entry is not activated by IGMP membership registration, but activated by the traffic. For an ordinary IGMP snooping entry, the IGMP protocol will take care of the aging out of the entry. For a data-driven entry, the entry can be specified not to age out or to age out by a timer.

When the data driven learning State is enabled, the multicast filtering mode for all ports is ignored. This means multicast packets will be flooded. Please note that if a data-driven group is created and IGMP member ports are learned later, the entry will become an ordinary IGMP snooping entry. In other words, the aging out mechanism will follow the conditions of an ordinary IGMP snooping entry.

Data driven learning is useful on a network which has video cameras connected to a Layer 2 switch that is recording and sending IP multicast data. The switch needs to forward IP data to a data center without dropping or flooding any packets. Since video cameras do not have the capability to run IGMP protocols, the IP multicast data will be dropped with the original IGMP snooping function.

To view the following window, click **L2 Features** > **IGMP Snooping** > **Data Driven Learning Settings**:

Figure 3 - 21. Date Driven Learning Settings window

The following parameters may be viewed or modified:

Parameter	Description
VLAN Name	Click this button and enter the VLAN to be configured (or use the VID List).
VID List	Click this button and enter the VID List to be configured (or use the VLAN Name).
State	Enable or disable data driven learning of IGMP snooping groups.
Age Out	Enable or disable aging on this entry.
Max Learned Entry (1-256)	Enter the maximum number of groups that can be learned by the data driven method. The default value is *56* entries.

ISM VLAN Settings

In a switching environment, multiple VLANs may exist. Every time a multicast query passes through the Switch, the switch must forward separate different copies of the data to each VLAN on the system, which, in turn, increases data traffic and may clog up the traffic path. To lighten the traffic load, multicast VLANs may be incorporated. These multicast VLANs will allow the Switch to forward this multicast traffic as one copy to recipients of the multicast VLAN, instead of multiple copies.

Regardless of other normal VLANs that are incorporated on the Switch, users may add any ports to the multicast VLAN where they wish multicast traffic to be sent. Users are to set up a source port, where the multicast traffic is entering the switch, and then set the ports where the incoming multicast traffic is to be sent. The source port cannot be a recipient port and if configured to do so, will cause error messages to be produced by the switch. Once properly configured, the stream of multicast data will be relayed to the receiver ports in a much more timely and reliable fashion.

Restrictions and Provisos

The Multicast VLAN feature of this Switch does have some restrictions and limitations, such as:

1. Multicast VLANs can be implemented on edge and non-edge switches.
2. Member ports and source ports can be used in multiple ISM VLANs. But member ports and source ports cannot be the same port in a specific ISM VLAN.
3. The Multicast VLAN is exclusive with normal 802.1q VLANs, which means that VLAN IDs (VIDs) and VLAN Names of 802.1q VLANs and ISM VLANs cannot be the same. Once a VID or VLAN Name is chosen for any VLAN, it cannot be used for any other VLAN.
4. The normal display of configured VLANs will not display configured Multicast VLANs.
5. Once an ISM VLAN is enabled, the corresponding IGMP snooping state of this VLAN will also be enabled. Users cannot disable the IGMP feature for an enabled ISM VLAN.
6. One IP multicast address cannot be added to multiple ISM VLANs, yet multiple Ranges can be added to one ISM VLAN.

Users can create and configure multicast VLANs for the Switch.

To view the following window, click **L2 Features > IGMP Snooping > ISM VLAN Settings**:

Figure 3 - 22. ISM VLAN Settings window

The following parameters may be viewed or modified:

Parameter	Description
ISM VLAN Global State	Enable or disable the IGMP Snooping Multicast (ISM) VLAN Global State.
VLAN Name	Enter the name of the new Multicast VLAN to be created. This name can be up to 32 characters in length. This field will display the pre-created name of a Multicast VLAN in the Modify window.
State	Use the pull-down menu to enable or disable the selected Multicast VLAN.
Member Port (e.g.: 1-4, 6)	Enter a port or list of ports to be added to the Multicast VLAN. Member ports shall be the untagged members of the multicast VLAN.
Tagged Member Port	Enter a port or list of ports that will become tagged members of the Multicast VLAN.
VID (2-4094)	Add or edit the corresponding VLAN ID of the Multicast VLAN. Users may enter a value between *2* and *4094.*
Replace Source IP	This field is used to replace the source IP address of incoming packets sent by the host before being forwarded to the source port.
Source Port (e.g.: 1-4, 6)	Enter a port or list of ports to be added to the Multicast VLAN. Source ports shall be the tagged members of the multicast VLAN.

ISM Profile Settings

Users can configure ISM profile settngs.

To view the following window, click **L2 Features** > **IGMP Snooping** > **ISM Profile Settings**:

Figure 3 - 23. ISM Profile Settings window

The following parameters may be viewed or modified:

Parameter	Description
Profile Name	Enter a name for the ISM Profile.

IP Multicast Profile Settings

Users can add a profile to which multicast address(es) reports are to be received on specified ports on the Switch. This function will therefore limit the number of reports received and the number of multicast groups configured on the Switch. The user may set an IP Multicast address or range of IP Multicast addresses to accept reports (Permit) or deny reports (Deny) coming into the specified switch ports.

To view the following window, click **L2 Features** > **IGMP Snooping** > **IP Multicast Profile Settings**:

Figure 3 - 24. IP Multicast Profile Settings window

The following fields can be set:

Parameter	Description
Profile ID	Enter a Profile ID between *1* and *24*.
Profile Name	Enter a name for the IP Multicast Profile.

To change an entry, click the corresponding **Modify** button in the Multicast Address List column. The **Multicast Address Group List Settings** window opens. To edit the name of an entry, click the corresponding **Edit** button in the Edit Profile Name column. To remove an entry, click the corresponding **Delete** button.

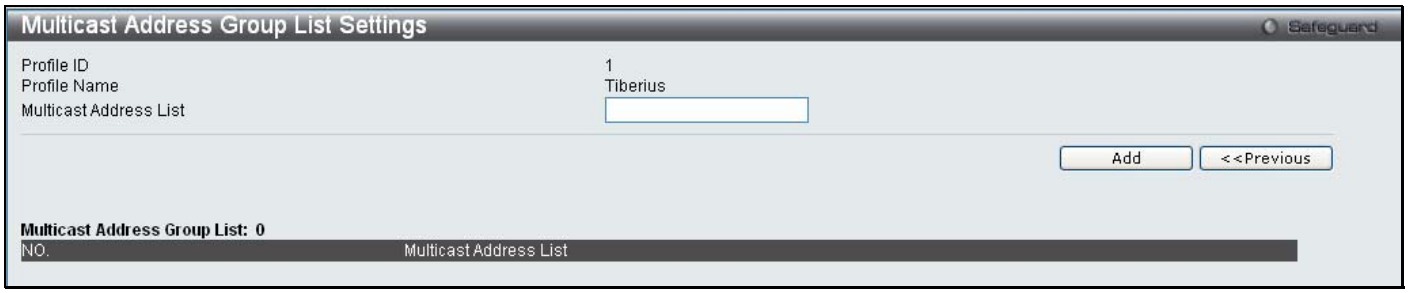


Figure 3 - 25. Multicast Address Group List Settings window

Enter the multicast IP address list, starting with the lowest in the range, and then click **Add**. To return to the **IP Multicast Profile Settings** window, click the **<<Previous** button.

Limited Multicast Address Range Settings

Users can configure the ports on the Switch that will be involved in the Limited IP Multicast Range. The user can configure the range of multicast ports that will be accepted by the source ports to be forwarded to the receiver ports.

To view the following window, click **L2 Features** > **IGMP Snooping** > **Limited Multicast Address Range Settings**:

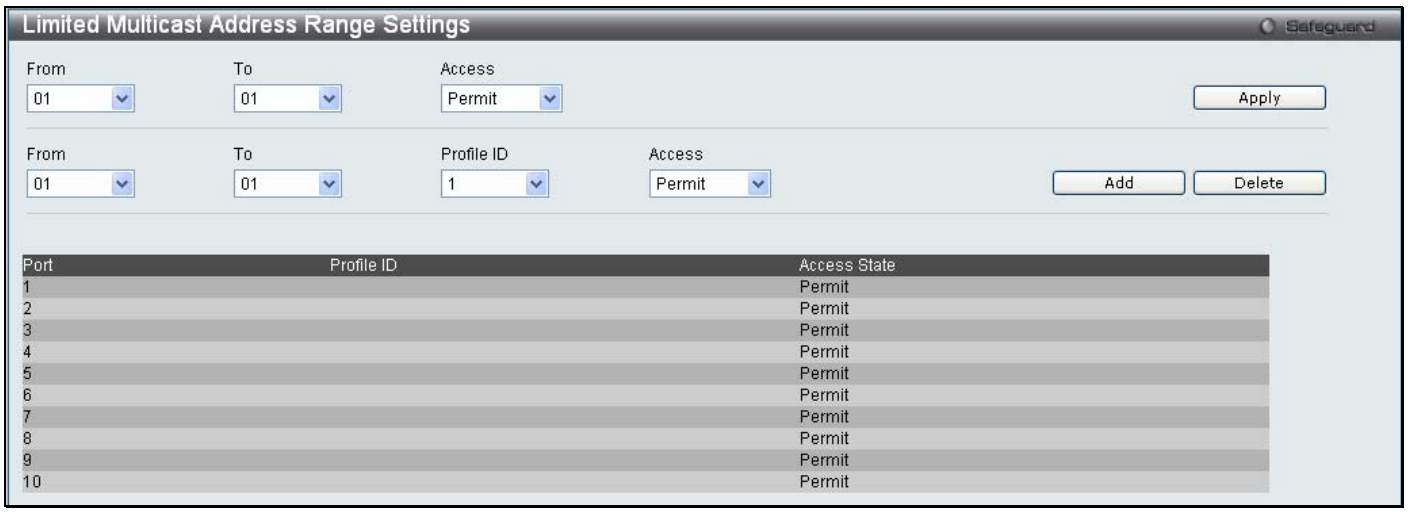


Figure 3 - 26. Limited Multicast Address Range Settings window

To add a new range, enter the appropriate information and then click **Add**. To delete an entry, enter the information and click **Delete**.

Max Multicast Group Settings

Users can configure the ports on the switch that will be a part of the maximum filter group, up to a maximum of 256.

To view the following window, click **L2 Features** > **IGMP Snooping** > **Max Multicast Group Settings**:

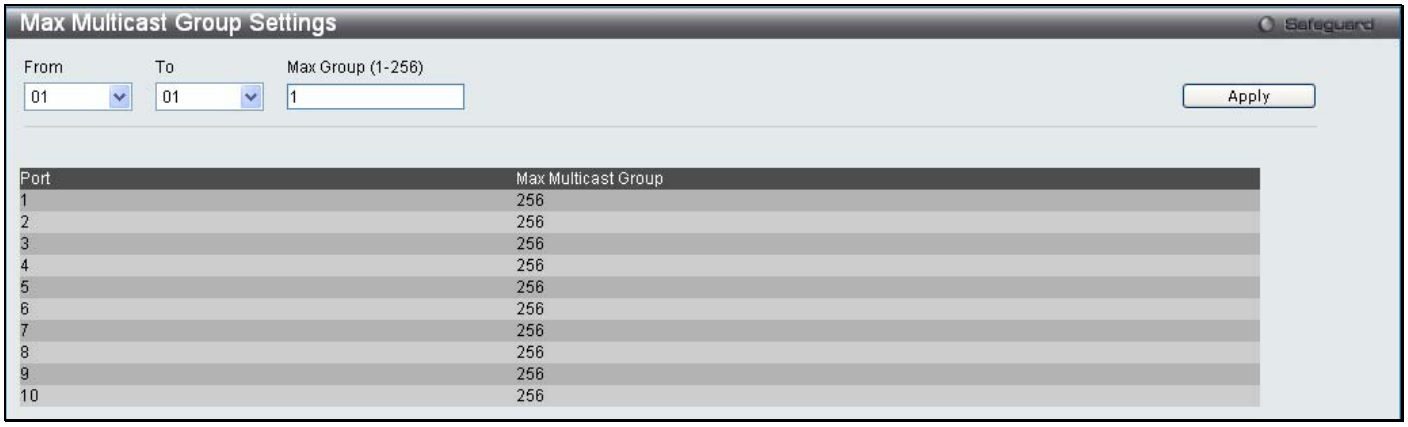


Figure 3- 27. Max Multicast Group Settings window

To add a Maximum Multicast Group range, enter the appropriate information and then click **Apply**.

MLD Snooping Settings

Multicast Listener Discovery (MLD) Snooping is an IPv6 function used similarly to IGMP snooping in IPv4. It is used to discover ports on a VLAN that are requesting multicast data. Instead of flooding all ports on a selected VLAN with multicast traffic, MLD snooping will only forward multicast data to ports that wish to receive this data through the use of queries and reports produced by the requesting ports and the source of the multicast traffic.

MLD snooping is accomplished through the examination of the layer 3 part of an MLD control packet transferred between end nodes and a MLD router. When the Switch discovers that this route is requesting multicast traffic, it adds the port directly attached to it into the correct IPv6 multicast table, and begins the process of forwarding multicast traffic to that port. This entry in the multicast routing table records the port, the VLAN ID, and the associated multicast IPv6 multicast group address, and then considers this port to be a active listening port. The active listening ports are the only ones to receive multicast group data.

MLD Control Messages

Three types of messages are transferred between devices using MLD snooping. These three messages are all defined by four ICMPv6 packet headers, labeled 130, 131, 132, and 143.

1. **Multicast Listener Query** – Similar to the IGMPv2 Host Membership Query for IPv4, and labeled as 130 in the ICMPv6 packet header, this message is sent by the router to ask if any link is requesting multicast data. There are two types of MLD query messages emitted by the router. The General Query is used to advertise all multicast addresses that are ready to send multicast data to all listening ports, and the Multicast Specific query, which advertises a specific multicast address that is also ready. These two types of messages are distinguished by a multicast destination address located in the IPv6 header and a multicast address in the Multicast Listener Query Message.
2. **Multicast Listener Report, Version 1** – Comparable to the Host Membership Report in IGMPv2, and labeled as 131 in the ICMP packet header, this message is sent by the listening port to the Switch stating that it is interested in receiving multicast data from a multicast address in response to the Multicast Listener Query message.
3. **Multicast Listener Done** – Akin to the Leave Group Message in IGMPv2, and labeled as 132 in the ICMPv6 packet header, this message is sent by the multicast listening port stating that it is no longer interested in receiving multicast data from a specific multicast group address, therefore stating that it is "done" with the multicast data from this address. Once this message is received by the Switch, it will no longer forward multicast traffic from a specific multicast group address to this listening port.

4. **Multicast Listener Report, Version 2** - Comparable to the Host Membership Report in IGMPv3, and labeled as 143 in the ICMP packet header, this message is sent by the listening port to the Switch stating that it is interested in receiving multicast data from a multicast address in response to the Multicast Listener Query message.

Users can configure the settings for MLD snooping.

To view the following window, click **L2 Features > MLD Snooping Settings**:

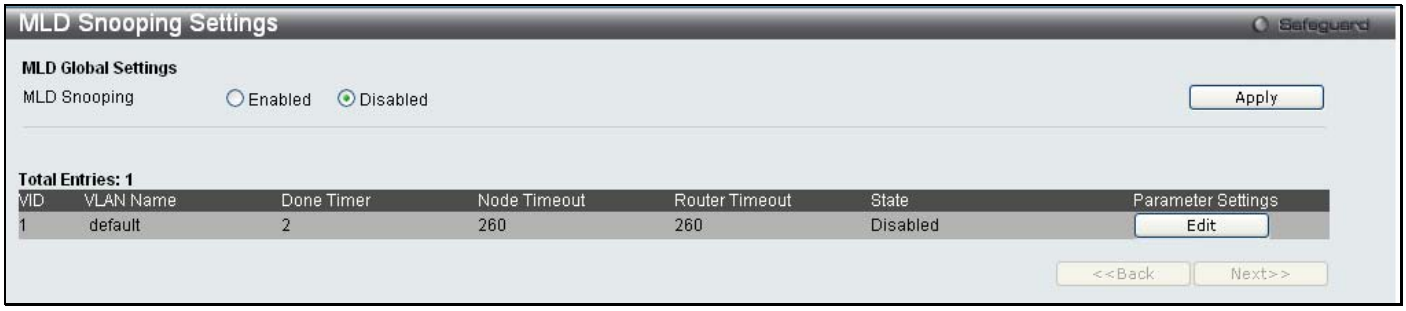


Figure 3 - 28. MLD Snooping Settings window

This window displays the current MLD Snooping settings set on the Switch, defined by VLAN. To configure a specific VLAN for MLD snooping, click the VLAN's corresponding **Edit** button.

The following parameters may be viewed or modified:

Parameter	Description
VID	This is the VLAN ID that, along with the VLAN Name, identifies the VLAN for which to modify the MLD Snooping Settings.
VLAN Name	This is the VLAN Name that, along with the VLAN ID, identifies the VLAN for which to modify the MLD Snooping Settings.
Done Timer	Specifies the maximum amount of time a router can remain in the Switch after receiving a done message from the group without receiving a node listener report. The user may specify a time between *1* and *16711450* with a default setting of *2* seconds.
Node Timeout	Specifies the link node timeout, in seconds. After this timer expires, this node will no longer be considered as listening node. The user may specify a time between *1* and *16711450* with a default setting of *260* seconds.
Router Timeout	Specifies the maximum amount of time a router can remain in the Switch's routing table as a listening node of a multicast group without the Switch receiving a node listener report. The user may specify a time between *1* and *16711450* with a default setting of *260* seconds.
State	Used to enable or disable MLD snooping for the specified VLAN. This field is *Disabled* by default.

Click **Apply** to implement changes made.

Port Mirroring

The Switch allows you to copy frames transmitted and received on a port and redirect the copies to another port. You can attach a monitoring device to the mirrored port, such as a sniffer or an RMON probe, to view details about the packets passing through the first port. This is useful for network monitoring and troubleshooting purposes.

To view the following window, click **L2 Features** > **Port Mirroring**:

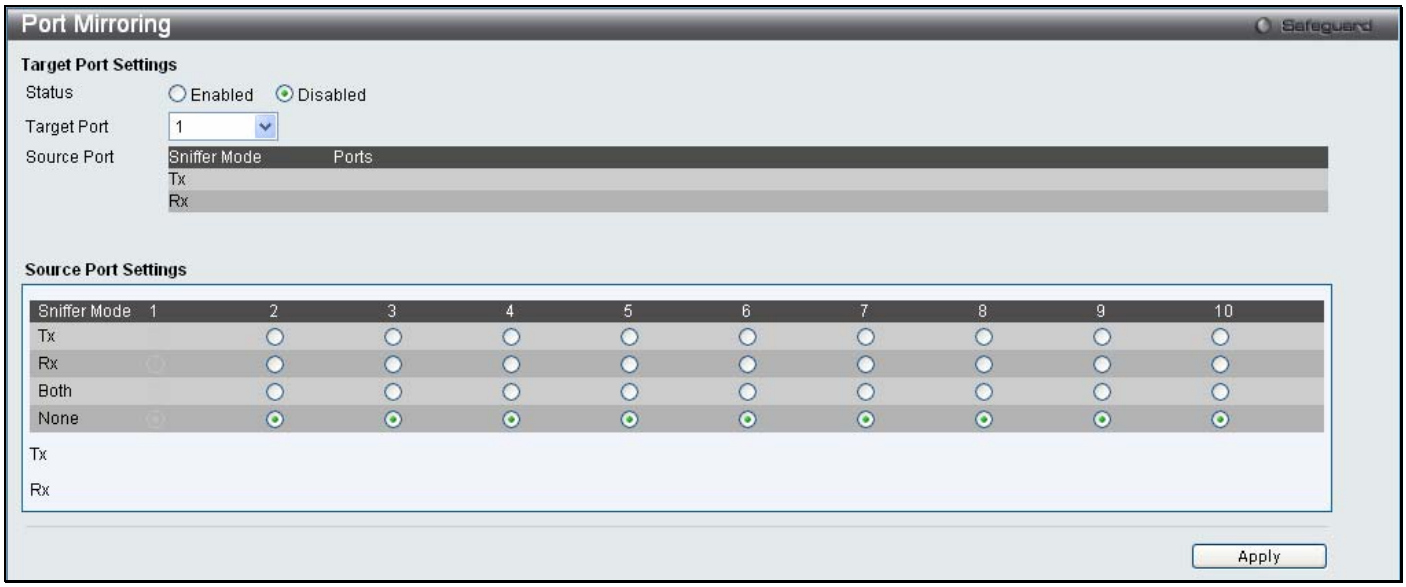


Figure 3 - 29. Port Mirroring window

To configure a mirror port:

1. Use the radio button to change the Target Port Settings Status to Enabled.
2. Use the drop-down menu to select the Target Port to which frames will be copied, which receives the copies from the source port
3. Select the Source Port Setting Direction, Tx (Egress), Rx (Ingress), Both, or None.
4. Click **Apply** to let the changes take effect.

NOTE: You cannot mirror a fast port onto a slower port. For example, if you try to mirror the traffic from a 100 Mbps port onto a 10 Mbps port, this can cause throughput problems. The port you are copying frames from should always support an equal or lower speed than the port to which you are sending the copies. Also, the target port for the mirroring cannot be a member of a trunk group. Please note a target port and a source port cannot be the same port.

NOTE: Target mirror ports cannot be members of a trunking group. Attempting to do so will produce an error message and the configuration will not be set.

Loopback Detection Settings

The Loopback Detection function is used to detect the loop created by a specific port. This feature is used to temporarily shutdown a port on the Switch when a CTP (Configuration Testing Protocol) packet has been looped back to the Switch. When the Switch detects CTP packets received from a port or a VLAN, this signifies a loop on the network. The Switch will automatically block the port or the VLAN and send an alert to the administrator. The Loopback Detection port will restart (change to discarding state) when the Loopback Detection Recover Time times out. The Loopback Detection function can be implemented on a range of ports at a time. The user may enable or disable this function using the pull-down menu.

To view the following window, click **L2 Features > Loopback Detection Settings**:

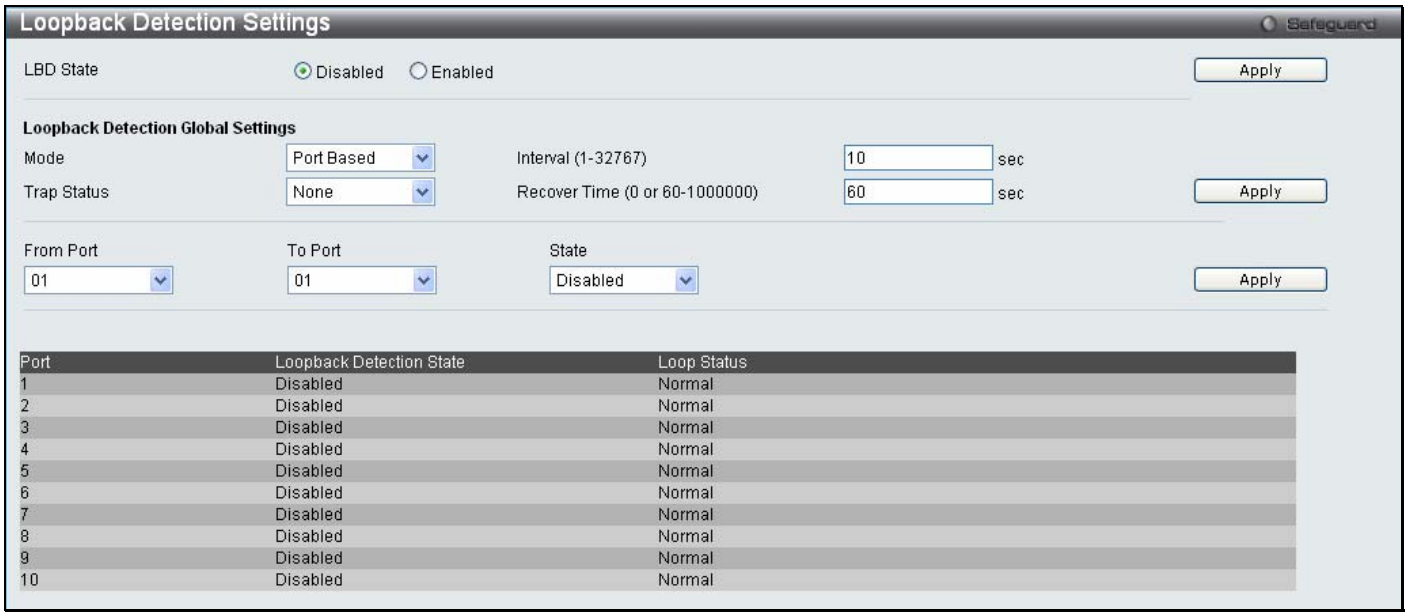


Figure 3 - 30. Loopback Detection Settings window (Port-based)

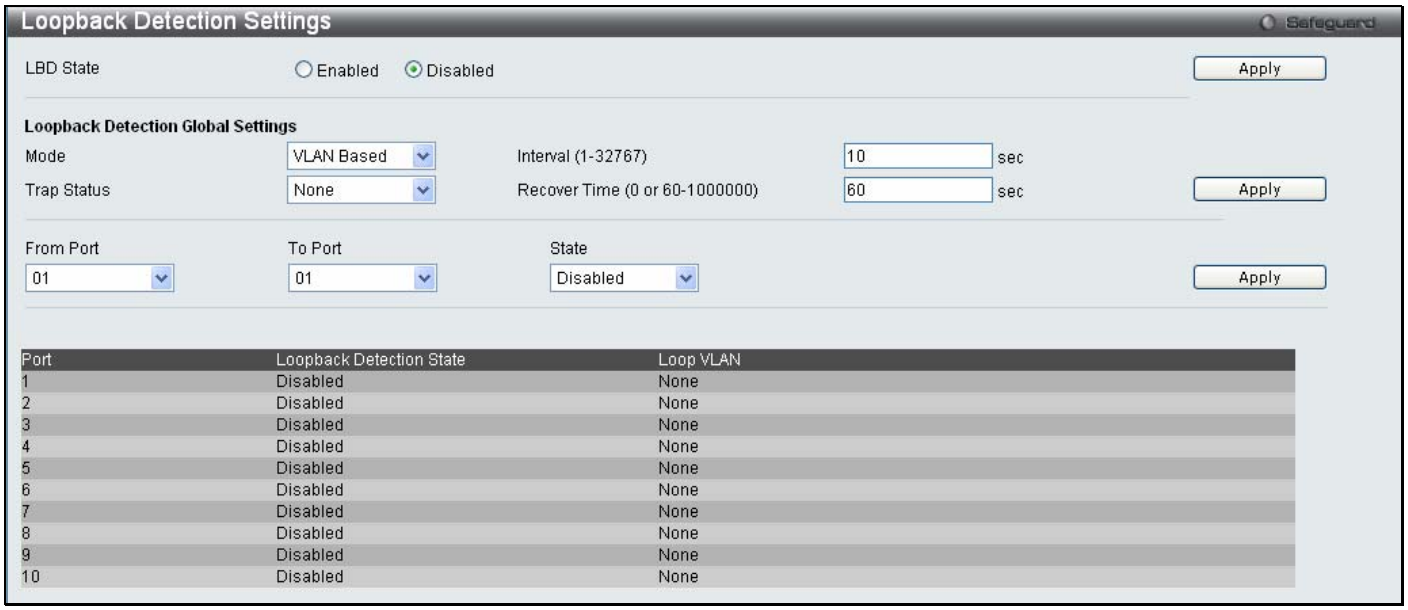


Figure 3 - 31. Loopback Detection Settings window (VLAN-based)

The following parameters may be viewed or modified:

Parameter	Description
LBD State	Use the drop-down menu to enable or disable loopback detection. The default is Disabled.
Mode	Use the drop-down menu to toggle between *Port Based* and *VLAN Based*.

Trap Status	Set the desired trap status: *None*, *Loop Detected*, *Loop Cleared*, or *Both*.
Interval (1-32767)	Set a Loopdetect Interval between *1* and *32767* seconds. The default is *10* seconds.
Recover Time (0 or 60-1000000)	Time allowed (in seconds) for recovery when a Loopback is detected. The Loopdetect Recover Time can be set at *0* seconds, or *60* to *1000000* seconds. Entering *0* will disable the Loopdetect Recover Time. The default is *60* seconds.
From Port	Use the drop-down menu to select a beginning port number.
To Port	Use the drop-down menu to select an ending port number.
State	Use the drop-down menu to toggle between *Enabled* and *Disabled*.

Click **Apply** to let the changes take effect.

Spanning Tree

This Switch supports three versions of the Spanning Tree Protocol: 802.1D-1998 STP, 802.1D-2004 Rapid STP, and 802.1Q-2005 MSTP. 802.1D-1998 STP will be familiar to most networking professionals. However, since 802.1D-2004 RSTP and 802.1Q-2005 MSTP have been recently introduced to D-Link managed Ethernet switches, a brief introduction to the technology is provided below followed by a description of how to set up 802.1D-1998 STP, 802.1D-2004 RSTP, and 802.1Q-2005 MSTP.

802.1Q-2005 MSTP

Multiple Spanning Tree Protocol, or MSTP, is a standard defined by the IEEE community that allows multiple VLANs to be mapped to a single spanning tree instance, which will provide multiple pathways across the network. Therefore, these MSTP configurations will balance the traffic load, preventing wide scale disruptions when a single spanning tree instance fails. This will allow for faster convergences of new topologies for the failed instance. Frames designated for these VLANs will be processed quickly and completely throughout interconnected bridges utilizing any of the three spanning tree protocols (STP, RSTP or MSTP).

This protocol will also tag BDPU packets so receiving devices can distinguish spanning tree instances, spanning tree regions and the VLANs associated with them. An MSTI ID will classify these instances. MSTP will connect multiple spanning trees with a Common and Internal Spanning Tree (CIST). The CIST will automatically determine each MSTP region, its maximum possible extent and will appear as one virtual bridge that runs a single spanning tree. Consequentially, frames assigned to different VLANs will follow different data routes within administratively established regions on the network, continuing to allow simple and full processing of frames, regardless of administrative errors in defining VLANs and their respective spanning trees.

Each switch utilizing the MSTP on a network will have a single MSTP configuration that will have the following three attributes:

1. A configuration name defined by an alphanumeric string of up to 32 characters (defined in the **MST Configuration Identification** window in the Configuration Name field).
2. A configuration revision number (named here as a Revision Level and found in the **MST Configuration Identification** window) and;
3. A 4094-element table (defined here as a VID List in the **MST Configuration Identification** window), which will associate each of the possible 4094 VLANs supported by the Switch for a given instance.

To utilize the MSTP function on the Switch, three steps need to be taken:

1. The Switch must be set to the MSTP setting (found in the **STP Bridge Global Settings** window in the STP Version field)
2. The correct spanning tree priority for the MSTP instance must be entered (defined here as a Priority in the **MSTI Config Information** window when configuring MSTI ID settings).
3. VLANs that will be shared must be added to the MSTP Instance ID (defined here as a VID List in the **MST Configuration Identification** window when configuring an MSTI ID settings).

802.1D-2004 Rapid Spanning Tree

The Switch implements three versions of the Spanning Tree Protocol, the Multiple Spanning Tree Protocol (MSTP) as defined by the IEEE 802.1Q-2005, the Rapid Spanning Tree Protocol (RSTP) as defined by the IEEE 802.1D-2004 specification and a version compatible with the IEEE 802.1D-1998 STP. RSTP can operate with legacy equipment implementing IEEE 802.1D-1998, however the advantages of using RSTP will be lost.

The IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP) evolved from the 802.1D-1998 STP standard. RSTP was developed in order to overcome some limitations of STP that impede the function of some recent switching innovations, in particular, certain Layer 3 functions that are increasingly handled by Ethernet switches. The basic function and much of the terminology is the same as STP. Most of the settings configured for STP are also used for RSTP. This section introduces some new Spanning Tree concepts and illustrates the main differences between the two protocols.

Port Transition States

An essential difference between the three protocols is in the way ports transition to a forwarding state and in the way this transition relates to the role of the port (forwarding or not forwarding) in the topology. MSTP and RSTP combine the transition states disabled, blocking and listening used in 802.1D-1998 and creates a single state Discarding. In either case, ports do not forward packets. In the STP port transition states disabled, blocking or listening or in the RSTP/MSTP port state discarding, there is no functional difference, the port is not active in the network topology. Table 7-3 below compares how the three protocols differ regarding the port state transition.

All three protocols calculate a stable topology in the same way. Every segment will have a single path to the root bridge. All bridges listen for BPDU packets. However, BPDU packets are sent more frequently - with every Hello packet. BPDU packets are sent even if a BPDU packet was not received. Therefore, each link between bridges is sensitive to the status of the link. Ultimately this difference results in faster detection of failed links, and thus faster topology adjustment. A drawback of 802.1D-1998 is this absence of immediate feedback from adjacent bridges.

802.1Q-2005 MSTP	802.1D-2004 RSTP	802.1D-1998 STP	Forwarding	Learning
Disabled	Disabled	Disabled	No	No
Discarding	*Discarding*	*Blocking*	No	No
Discarding	*Discarding*	*Listening*	No	No
Learning	*Learning*	*Learning*	No	**Yes**
Forwarding	**Forwarding**	**Forwarding**	**Yes**	**Yes**

Table 3 - 2. Comparing Port States

RSTP is capable of a more rapid transition to a forwarding state - it no longer relies on timer configurations - RSTP compliant bridges are sensitive to feedback from other RSTP compliant bridge links. Ports do not need to wait for the topology to stabilize before transitioning to a forwarding state. In order to allow this rapid transition, the protocol introduces two new variables: the edge port and the point-to-point (P2P) port.

Edge Port

The edge port is a configurable designation used for a port that is directly connected to a segment where a loop cannot be created. An example would be a port connected directly to a single workstation. Ports that are designated as edge ports transition to a forwarding state immediately without going through the listening and learning states. An edge port loses its status if it receives a BPDU packet, immediately becoming a normal spanning tree port.

P2P Port

A P2P port is also capable of rapid transition. P2P ports may be used to connect to other bridges. Under RSTP/MSTP, all ports operating in full-duplex mode are considered to be P2P ports, unless manually overridden through configuration.

802.1D-1998/802.1D-2004/802.1Q-2005 Compatibility

MSTP or RSTP can interoperate with legacy equipment and is capable of automatically adjusting BPDU packets to 802.1D-1998 format when necessary. However, any segment using 802.1D-1998 STP will not benefit from the rapid transition and rapid topology change detection of MSTP or RSTP. The protocol also provides for a variable used for migration in the event that legacy equipment on a segment is updated to use RSTP or MSTP.

The Spanning Tree Protocol (STP) operates on two levels:

1. On the switch level, the settings are globally implemented.
2. On the port level, the settings are implemented on a per user-defined group of ports basis.

STP Bridge Global Settings

Use the STP Status radio buttons to enable or disable STP globally, and use the STP Version drop-down menu to choose the STP method.

To view the following windows, click **L2 Features** > **Spanning Tree** > **STP Bridge Global Settings**:

Figure 3 - 32. STP Bridge Global Settings window – RSTP (default)

Figure 3 - 33. STP Bridge Global Settings window – MSTP

Figure 3 - 34. STP Bridge Global Settings window – STP Compatible

See the table below for descriptions of the STP versions and corresponding setting options.

NOTE: The Bridge Hello Time cannot be longer than the Bridge Max Age. Otherwise, a configuration error will occur. Observe the following formulas when setting the above parameters:

Bridge Max Age <= 2 x (Bridge Forward Delay - 1 second)

Bridge Max Age > 2 x (Bridge Hello Time + 1 second)

Configure the following parameters for STP:

Parameter	Description
STP Status	Use the radio button to globally enable or disable STP.
STP Version	Use the pull-down menu to choose the desired version of STP: *STP* - Select this parameter to set the Spanning Tree Protocol (STP) globally on the switch. *RSTP* - Select this parameter to set the Rapid Spanning Tree Protocol (RSTP) globally on the Switch. *MSTP* - Select this parameter to set the Multiple Spanning Tree Protocol (MSTP) globally on the Switch.
Forwarding BPDU	This field can be *Enabled* or *Disabled.* When *Enabled,* it allows the forwarding of STP BPDU packets from other network devices. The default is *Enabled*.
Bridge Max Age (6 – 40)	The Max Age may be set to ensure that old information does not endlessly circulate through redundant paths in the network, preventing the effective propagation of the new information. Set by the Root Bridge, this value will aid in determining that the Switch has spanning tree configuration values consistent with other devices on the bridged LAN. The user may choose a time between *6* and *40* seconds. The default value is *20* seconds.
Bridge Hello Time (1 – 2)	The Hello Time can be set from *1* to *2* seconds. This is the interval between two transmissions of BPDU packets sent by the Root Bridge to tell all other switches that it is indeed the Root Bridge. This field will only appear here when STP or RSTP is selected for the STP Version. For MSTP, the Hello Time must be set on a port per port basis. The default is *2* seconds.
Bridge Forward Delay (4 – 30)	The Forward Delay can be from *4* to *30* seconds. Any port on the Switch spends this time in the listening state while moving from the blocking state to the forwarding state. The default is *15* seconds
Tx Hold Count (1-10)	Used to set the maximum number of Hello packets transmitted per interval. The count can be specified from *1* to *10*. The default is *6*.
Max Hops (6-40)	Used to set the number of hops between devices in a spanning tree region before the BPDU (bridge protocol data unit) packet sent by the Switch will be discarded. Each switch on the hop count will reduce the hop count by one until the value reaches zero. The Switch will then discard the BDPU packet and the information held for the port will age out. The user may set a hop count from *6* to *40*. The default is *20*.

Click **Apply** to implement changes made.

STP Port Settings

STP can be set up on a port per port basis.

To view the following window, click **L2 Features > Spanning Tree > STP Port Settings**:

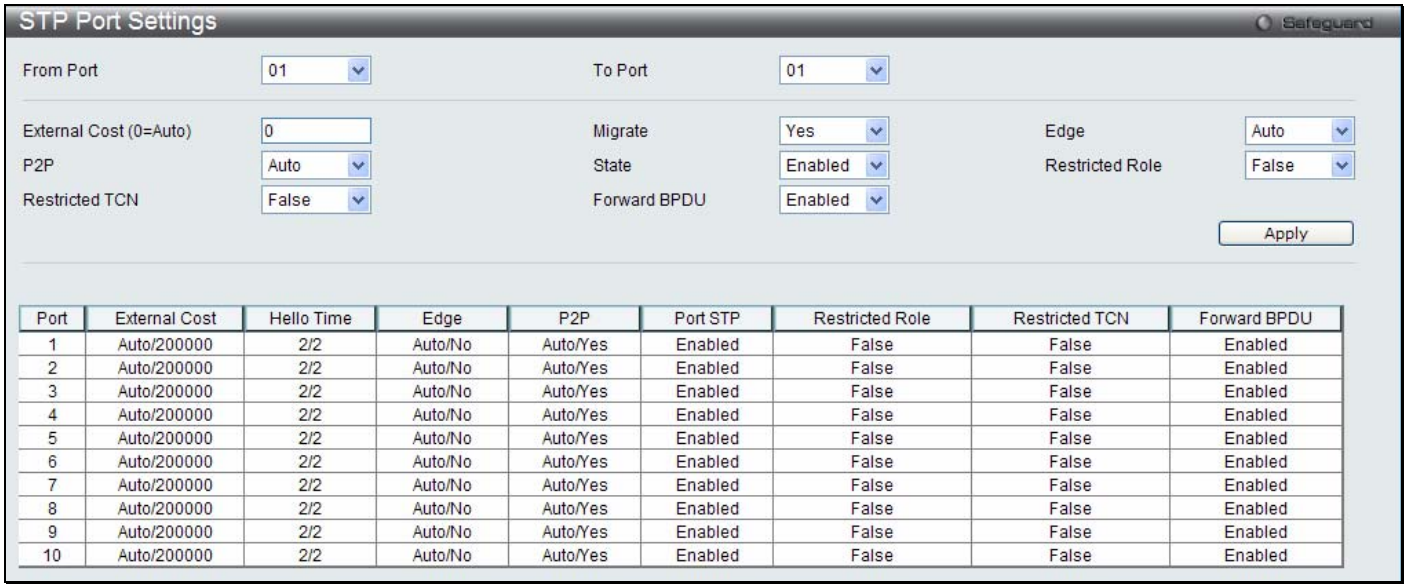

STP Port Settings
Safeguard
From Port
01
To Port
01
External Cost (0=Auto)
0
Migrate
Yes
Edge
Auto
P2P
Auto
State
Enabled
Restricted Role
False
Restricted TCN
False
Forward BPDU
Enabled
Apply
Port | External Cost | Hello Time | Edge | P2P | Port STP | Restricted Role | Restricted TCN | Forward BPDU
1 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
2 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
3 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
4 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
5 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
6 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
7 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
8 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
9 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled
10 | Auto/200000 | 2/2 | Auto/No | Auto/Yes | Enabled | False | False | Enabled

Figure 3 - 35. STP Port Settings window

It is advisable to define an STP Group to correspond to a VLAN group of ports.

The following STP Port Settings fields can be set:

Parameter	Description
From Port	The beginning port in a consecutive group of ports to be configured.
To Port	The ending port in a consecutive group of ports to be configured.
External Cost (0=Auto)	This defines a metric that indicates the relative cost of forwarding packets to the specified port list. Port cost can be set automatically or as a metric value. The default value is *0* (auto). Setting *0* for the external cost will automatically set the speed for forwarding packets to the specified port(s) in the list for optimal efficiency. The default port cost for a 100Mbps port is *200000* and the default port cost for a Gigabit port is *20000*. Enter a value between *1* and *200000000* to determine the External Cost. The lower the number, the greater the probability the port will be chosen to forward packets.
P2P	Choosing the *True* parameter indicates a point-to-point (P2P) shared link. P2P ports are similar to edge ports, however they are restricted in that a P2P port must operate in full duplex. Like edge ports, P2P ports transition to a forwarding state rapidly thus benefiting from RSTP. A P2P value of *False* indicates that the port cannot have P2P status. *Auto* allows the port to have P2P status whenever possible and operate as if the P2P status were *True*. If the port cannot maintain this status, (for example if the port is forced to half-duplex operation) the P2P status changes to operate as if the P2P value were *False*. The default setting for this parameter is *Auto*.
Restricted TCN	Topology Change Notification is a simple BPDU that a bridge sends out to its root port to signal a topology change. Restricted TCN can be toggled between *True* and *False*. If set to *True*, this stops the port from propagating received topology change notifications and topology changes to other ports. The default is *False*.
Migrate	When operating in RSTP mode, selecting *Yes* forces the port that has been selected to transmit RSTP BPDUs.
State	This drop-down menu allows you to enable or disable STP for the selected group of ports. The default is *Enabled*.
Forward BPDU	Use the pull-down menu to enable or disable the flooding of BPDU packets when STP is disabled.
Edge	Choosing the *True* parameter designates the port as an edge port. Edge ports cannot create loops, however an edge port can lose edge port status if a topology change creates a potential for a loop. An edge port normally should not receive BPDU packets. If a BPDU packet is

	received, it automatically loses edge port status. Choosing the *False* parameter indicates that the port does not have edge port status. Alternatively, the *Auto* option is available.
Restricted Role	Use the drop-down menu to toggle Restricted Role between *True* and *False*. If set to *True*, the port will never be selected to be the Root port. The default is *False*.
Hello Time (sec)	This is a per-Bridge parameter in RSTP, but it becomes a per-Port parameter in MSTP. The default value is *2*.

Click **Apply** to implement changes made.

MST Configuration Identification

This window allows the user to configure a MSTI instance on the Switch. These settings will uniquely identify a multiple spanning tree instance set on the Switch. The Switch initially possesses one CIST, or Common Internal Spanning Tree, of which the user may modify the parameters for but cannot change the MSTI ID for, and cannot be deleted.

To view the following window, click **L2 Features > Spanning Tree > MST Configuration Identification**:

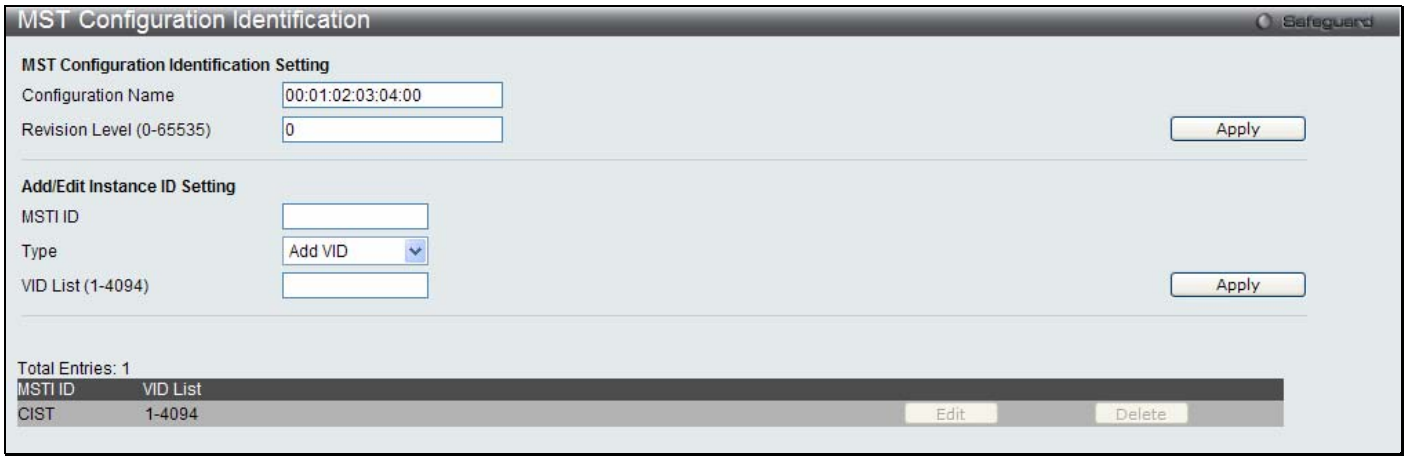


Figure 3 - 36. MST Configuration Identification window

To modify an entry on the table at the bottom of the window, click the corresponding **Edit** button. To remove an entry on the table at the bottom of the window, click the corresponding **Delete** button.

The window above contains the following information:

Parameter	Description
Configuration Name	This name uniquely identifies the MSTI (Multiple Spanning Tree Instance). If a Configuration Name is not set, this field will show the MAC address to the device running MSTP.
Revision Level (0-65535)	This value, along with the Configuration Name, identifies the MSTP region configured on the Switch.
MSTI ID	Enter a number between *1* and *15* to set a new MSTI on the Switch.
Type	This field allows the user to choose a desired method for altering the MSTI settings. The user has two choices: *Add VID* - Select this parameter to add VIDs to the MSTI ID, in conjunction with the VID List parameter. *Remove VID* - Select this parameter to remove VIDs from the MSTI ID, in conjunction with the VID List parameter.
VID List (1-4094)	This field is used to specify the VID range from configured VLANs set on the Switch. Supported VIDs on the Switch range from ID number *1* to *4094*.

Click **Apply** to implement changes made.

STP Instance Settings

This window displays MSTIs currently set on the Switch and allows users to change the Priority of the MSTIs.

To view the following window, click **L2 Features > Spanning Tree > STP Instance Settings**:

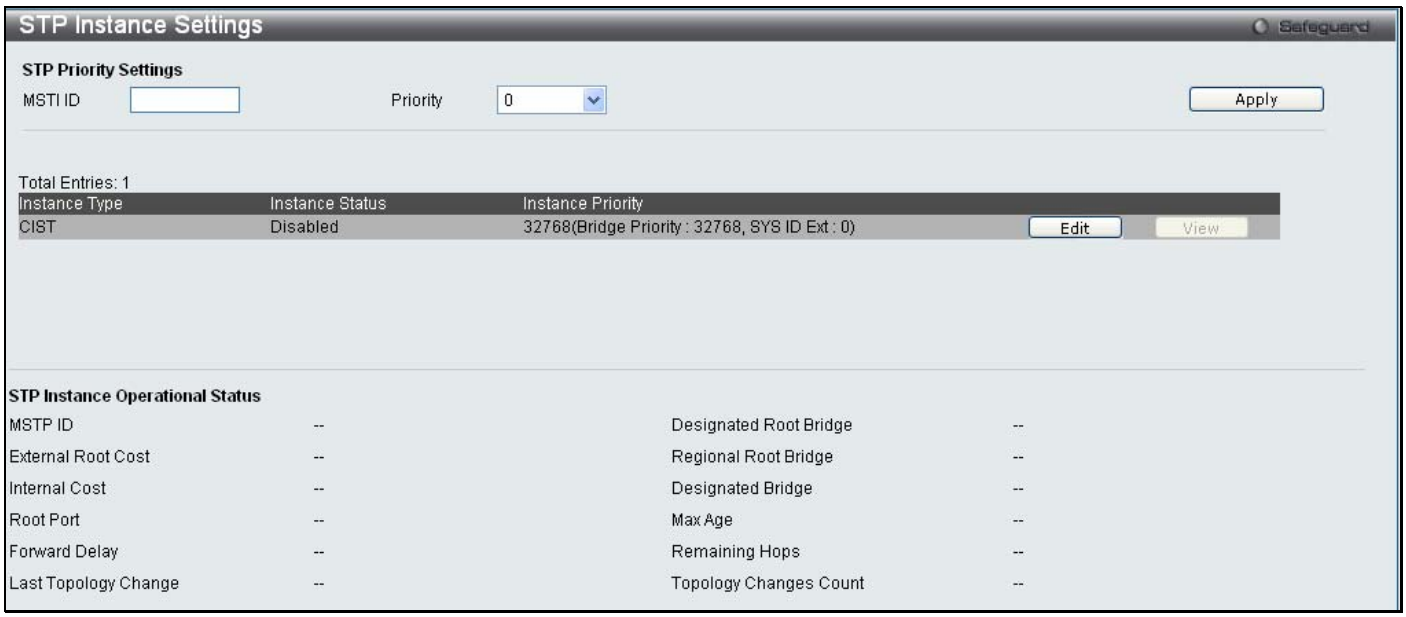


Figure 3 - 37. STP Instance Settings window

To modify an entry on the table at the top of the window, click the corresponding **Edit** button. To view more information about an entry on the table at the top of the window, click the corresponding **View** button.

The window above contains the following information:

Parameter	Description
MSTI ID	Enter the MSTI ID in this field. An entry of *0* denotes the CIST (default MSTI).
Priority	Enter the priority in this field. The available range of values is from *0* to *61440*.

Click **Apply** to implement the new priority setting.

MSTP Port Information

This window displays the current MSTI configuration information and can be used to update the port configuration for an MSTI ID. If a loop occurs, the MSTP function will use the port priority to select an interface to put into the forwarding state. Set a higher priority value for interfaces to be selected for forwarding first. In instances where the priority value is identical, the MSTP function will implement the lowest MAC address into the forwarding state and other interfaces will be blocked. Remember that lower priority values mean higher priorities for forwarding packets.

To view the following window, click **L2 Features > Spanning Tree > MSTP Port Information**:

Figure 3 - 38. MSTP Port Information window

To view the MSTI settings for a particular port, use the drop-down menu to select the Port number. To modify the settings for a particular MSTI instance, enter a value in the Instance ID field, an Internal Path Cost, and use the drop-down menu to select a Priority.

The user may configure the following parameters:

Parameter	Description
Instance ID	The MSTI ID of the instance to be configured. Enter a value between *0* and *15*. An entry of *0* in this field denotes the CIST (default MSTI).
Internal Path Cost	This parameter is set to represent the relative cost of forwarding packets to specified ports when an interface is selected within an STP instance. Selecting this parameter with a value in the range of *1* to *200000000* will set the quickest route when a loop occurs. A lower Internal cost represents a quicker transmission. Selecting *0* (zero) for this parameter will set the quickest route automatically and optimally for an interface.
Priority	Enter a value between *0* and *240* to set the priority for the port interface. A higher priority will designate the interface to forward packets first. A lower number denotes a higher priority.

Click **Apply** to implement the changes made.

Forwarding & Filtering

The **Forwarding & Filtering** folder contains three windows: **Unicast Forwarding**, **Multicast Forwarding**, and **Multicast Filtering Mode**.

Unicast Forwarding

Users can set up unicast forwarding on the Switch.

To view the following window, click **L2 Features** > **Forwarding & Filtering** > **Unicast Forwarding**:

Figure 3 - 39. Unicast Forwarding window

To add an entry to the Static Unicast Forwarding Table, define the following parameters. To modify an entry on the Static Unicast Forwarding Table, click the **Edit** button corresponding to the entry. To delete an entry in the Static Unicast Forwarding Table, click the corresponding **Delete** button.

Parameter	Description
VLAN ID (VID)	The VLAN ID number of the VLAN on which the associated unicast MAC address resides.
MAC Address	The MAC address to which packets will be statically forwarded. This must be a unicast MAC address.
Port	Allows the selection of the port number on which the MAC address entered above resides.

Click **Apply** to implement the changes made.

Multicast Forwarding

Users can set up multicast forwarding on the Switch.

To view the following window, click **L2 Features** > **Forwarding & Filtering** > **Multicast Forwarding**:

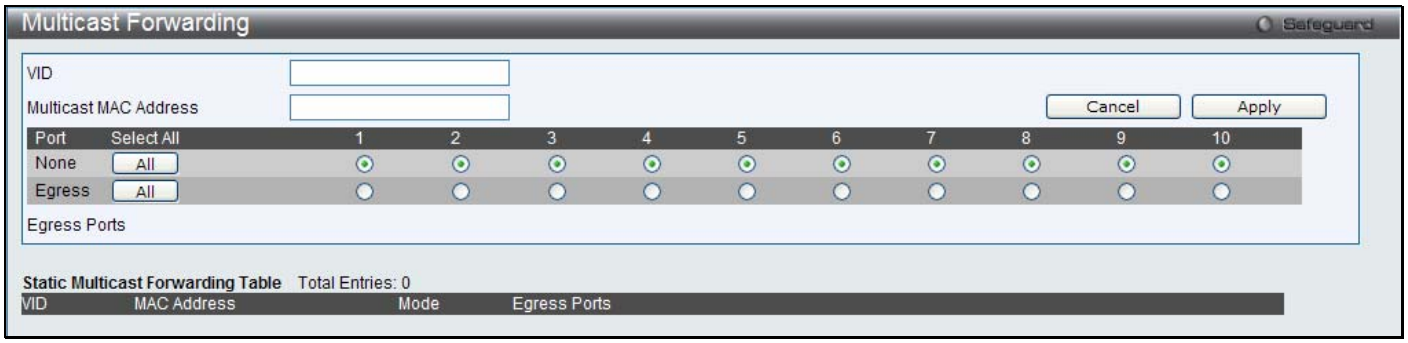


Figure 3 - 40. Multicast Forwarding window

This window displays all of the entries made into the Switch's static multicast forwarding table. The following parameters can be set:

Parameter	Description
VID	The VLAN ID of the VLAN the corresponding MAC address belongs to.
Multicast MAC Address	The static destination MAC address of the multicast packets. This must be a multicast MAC address.
Port	Allows the selection of ports that will be members of the static multicast group and ports that are either forbidden from joining dynamically, or that can join the multicast group dynamically, using GMRP. The options are: *None* - No restrictions on the port dynamically joining the multicast group. When *None* is chosen, the port will not be a member of the Static Multicast Group. *Egress* - The port is a static member of the multicast group.

Click **Apply** to implement the changes made. To delete an entry in the Static Multicast Forwarding Table, click the corresponding **Delete** button.

Multicast Filtering Mode

Users can configure the multicast filtering mode.

To view the following window, click **L2 Features** > **Forwarding & Filtering** > **Multicast Filtering Mode**:

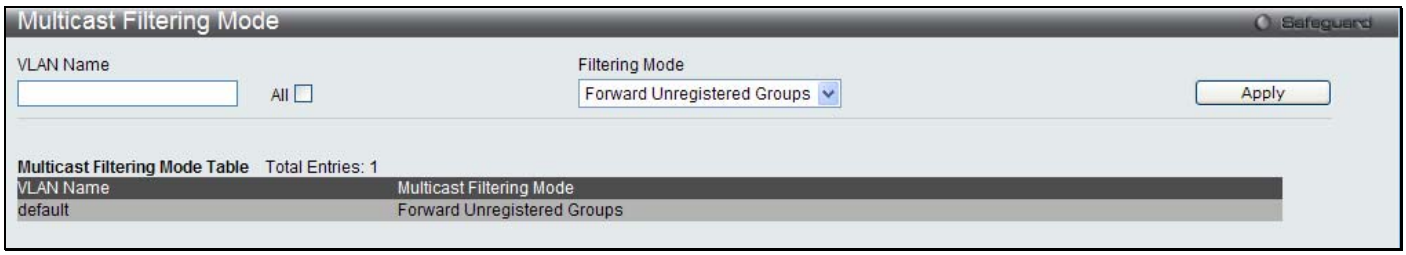


Figure 3 - 41. Multicast Filtering Mode window

Parameter	Description
VLAN Name	The VLAN to which the specified filtering action applies. Select the All option to apply the action to all VLANs on the Switch.
Filtering Mode	This drop-down menu allows you to select the action the Switch will take when it receives a multicast packet that requires forwarding to a port in the specified VLAN. • *Forward Unregistered Groups* – This will instruct the Switch to forward a multicast packet whose destination is an unregistered multicast group residing within the range of ports specified above. • *Filter Unregistered Groups* – This will instruct the Switch to filter any multicast packets whose destination is an unregistered multicast group residing within the range of ports specified above.

Click **Apply** to implement changes made.

Section 4

QoS

Bandwidth Control

Traffic Control

802.p Default Priority

802.1p User Priority

QoS Scheduling Mechanism

QoS is an implementation of the IEEE 802.1p standard that allows network administrators a method of reserving bandwidth for important functions that require a large bandwidth or have a high priority, such as VoIP (voice-over Internet Protocol), web browsing applications, file server applications or video conferencing. Not only can a larger bandwidth be created, but other less critical traffic can be limited, so excessive bandwidth can be saved. The Switch has separate hardware queues on every physical port to which packets from various applications can be mapped to, and, in turn prioritized. View the following map to see how the Switch implements basic 802.1P priority queuing.

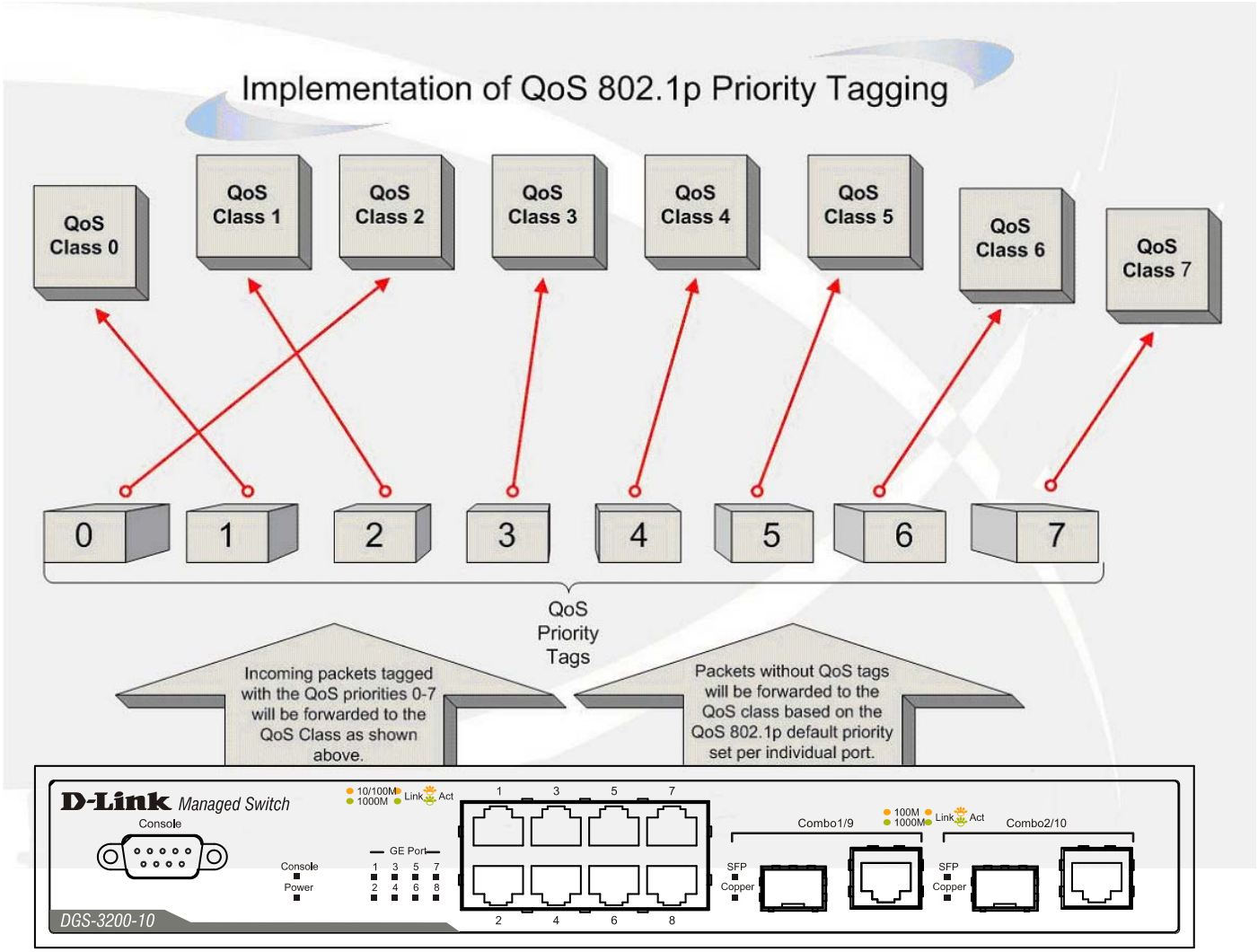


Figure 4 - 1. An Example of the Default QoS Mapping on the Switch

The picture above shows the default priority setting for the Switch. Class-7 has the highest priority of the seven priority classes of service on the Switch. In order to implement QoS, the user is required to instruct the Switch to examine the header of a packet to

see if it has the proper identifying tag. Then the user may forward these tagged packets to designated classes of service on the Switch where they will be emptied, based on priority.

For example, let's say a user wishes to have a video conference between two remotely set computers. The administrator can add priority tags to the video packets being sent out, utilizing the Access Profile commands. Then, on the receiving end, the administrator instructs the Switch to examine packets for this tag, acquires the tagged packets and maps them to a class queue on the Switch. Then in turn, the administrator will set a priority for this queue so that will be emptied before any other packet is forwarded. This results in the end user receiving all packets sent as quickly as possible, thus prioritizing the queue and allowing for an uninterrupted stream of packets, which optimizes the use of bandwidth available for the video conference.

Understanding QoS

The Switch supports 802.1p priority queuing. The Switch has eight priority queues. These priority queues are numbered from 7 (Class 7) — the highest priority queue — to 0 (Class 0) — the lowest priority queue. The eight priority tags specified in IEEE 802.1p (p0 to p7) are mapped to the Switch's priority queues as follows:

- Priority 0 is assigned to the Switch's Q2 queue.
- Priority 1 is assigned to the Switch's Q0 queue.
- Priority 2 is assigned to the Switch's Q1 queue.
- Priority 3 is assigned to the Switch's Q3 queue.
- Priority 4 is assigned to the Switch's Q4 queue.
- Priority 5 is assigned to the Switch's Q5 queue.
- Priority 6 is assigned to the Switch's Q6 queue.
- Priority 7 is assigned to the Switch's Q7 queue.

For strict priority-based scheduling, any packets residing in the higher priority classes of service are transmitted first. Multiple strict priority classes of service are emptied based on their priority tags. Only when these classes are empty, are packets of lower priority transmitted.

For weighted round-robin queuing, the number of packets sent from each priority queue depends upon the assigned weight. For a configuration of eight CoS queues, A~H with their respective weight value: 8~1, the packets are sent in the following sequence: A1, B1, C1, D1, E1, F1, G1, H1, A2, B2, C2, D2, E2, F2, G2, A3, B3, C3, D3, E3, F3, A4, B4, C4, D4, E4, A5, B5, C5, D5, A6, B6, C6, A7, B7, A8, A1, B1, C1, D1, E1, F1, G1, H1.

For weighted round-robin queuing, if each CoS queue has the same weight value, then each CoS queue has an equal opportunity to send packets just like round-robin queuing.

For weighted round-robin queuing, if the weight for a CoS is set to 0, then it will continue processing the packets from this CoS until there are no more packets for this CoS. The other CoS queues that have been given a nonzero value, and depending upon the weight, will follow a common weighted round-robin scheme.

Remember that the Switch has seven configurable priority queues (and seven Classes of Service) for each port on the Switch.

NOTICE: The Switch contains eight classes of service for each port on the Switch. One of these classes is reserved for internal use on the Switch and is therefore not configurable. All references in the following section regarding classes of service will refer to only the seven classes of service that may be used and configured by the administrator.

Bandwidth Control

The bandwidth control settings are used to place a ceiling on the transmitting and receiving data rates for any selected port.

To view the following window, click **QoS** > **Bandwidth Control**:

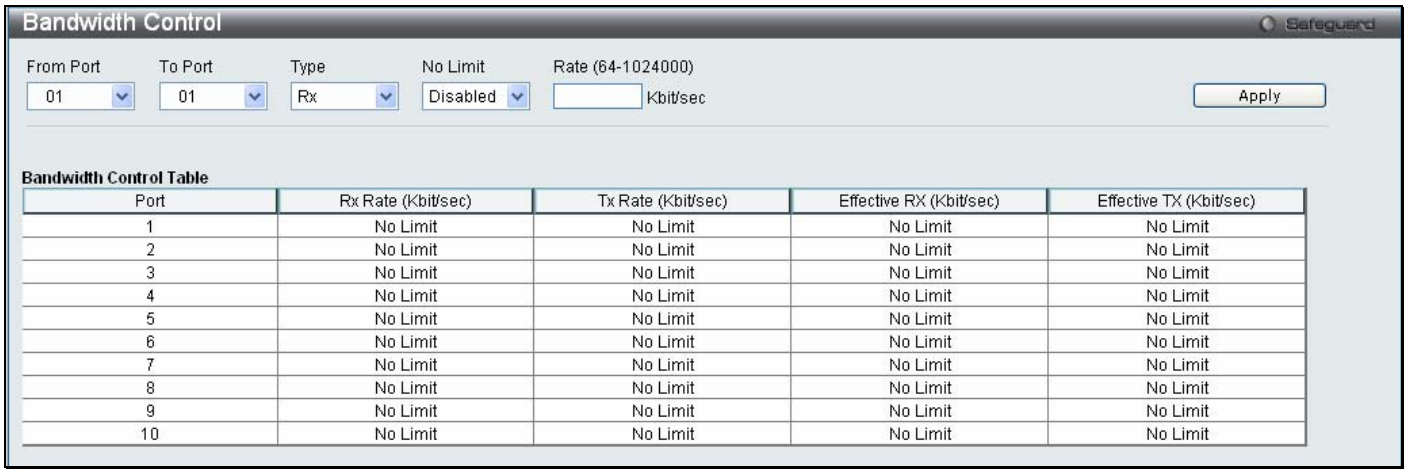

Bandwidth Control
Safeguard
From Port
To Port
Type
No Limit
Rate (64-1024000)
01
01
Rx
Disabled
Kbit/sec
Apply
Bandwidth Control Table
Port
Rx Rate (Kbit/sec)
Tx Rate (Kbit/sec)
Effective RX (Kbit/sec)
Effective TX (Kbit/sec)
1 No Limit No Limit No Limit No Limit
2 No Limit No Limit No Limit No Limit
3 No Limit No Limit No Limit No Limit
4 No Limit No Limit No Limit No Limit
5 No Limit No Limit No Limit No Limit
6 No Limit No Limit No Limit No Limit
7 No Limit No Limit No Limit No Limit
8 No Limit No Limit No Limit No Limit
9 No Limit No Limit No Limit No Limit
10 No Limit No Limit No Limit No Limit

Figure 4 - 2. Bandwidth Control window

The following parameters can be set or are displayed:

Parameter	Description
From Port	The beginning port of a consecutive group of ports to be configured.
To Port	The ending port of a consecutive group of ports to be configured.
Type	This drop-down menu allows a selection between *RX* (receive), *TX* (transmit), and *Both*. This setting will determine whether the bandwidth ceiling is applied to receiving, transmitting, or both receiving and transmitting packets.
No Limit	This drop-down menu allows the user to specify that the selected port will have no bandwidth limit or not.
Rate (64-1024000)	This field allows the input of the data rate that will be the limit for the selected port. The user may choose a rate between *64* and *1024000* Kbits per second.
Effective RX	If a RADIUS server has assigned the RX bandwidth, then it will be the effective RX bandwidth. The authentication with the RADIUS sever can be per port or per user. For per user authentication, there may be multiple RX bandwidths assigned if there are multiple users attached to this specific port. The final RX bandwidth will be the largest one among these multiple RX bandwidths.
Effective TX	If a RADIUS server has assigned the TX bandwidth, then it will be the effective TX bandwidth. The authentication with the RADIUS sever can be per port or per user. For per user authentication, there may be multiple TX bandwidths assigned if there are multiple users attached to this specific port. The final TX bandwidth will be the largest one among these multiple TX bandwidths.

Click **Apply** to set the bandwidth control for the selected ports. Results of configured Bandwidth Settings are displayed in the Bandwidth Control Table at the bottom of the window.

Traffic Control

On a computer network, packets such as Multicast packets and Broadcast packets continually flood the network as normal procedure. At times, this traffic may increase do to a malicious endstation on the network or a malfunctioning device, such as a faulty network card. Thus, switch throughput problems will arise and consequently affect the overall performance of the switch network. To help rectify this packet storm, the Switch will monitor and control the situation.

Packet storms are monitored to determine if too many packets are flooding the network based on threshold levels provided by the user. Once a packet storm has been detected, the Switch will drop packets coming into the Switch until the storm has subsided. This method can be utilized by selecting the *Drop* option of the Action parameter in the window below.

The Switch will also scan and monitor packets coming into the Switch by monitoring the Switch's chip counter. This method is only viable for Broadcast and Multicast storms because the chip only has counters for these two types of packets. Once a storm has been detected (that is, once the packet threshold set below has been exceeded), the Switch will shut down the port to all incoming traffic, with the exception of STP BPDU packets, for a time period specified using the Count Down parameter.

If a Time Interval parameter times-out for a port configured for traffic control and a packet storm continues, that port will be placed in Shutdown Forever mode, which will cause a warning message to be sent to the Trap Receiver. Once in Shutdown Forever mode, the only method of recovering the port is to manually recoup it using the **Port Settings** window in the **Configuration** folder. Select the disabled port and return its State to *Enabled* status. To utilize this method of Storm Control, choose the *Shutdown* option of the Action parameter in the window below.

Use this window to enable or disable storm control and adjust the threshold for multicast and broadcast storms.

To view the following window, click **QoS > Traffic Control**:

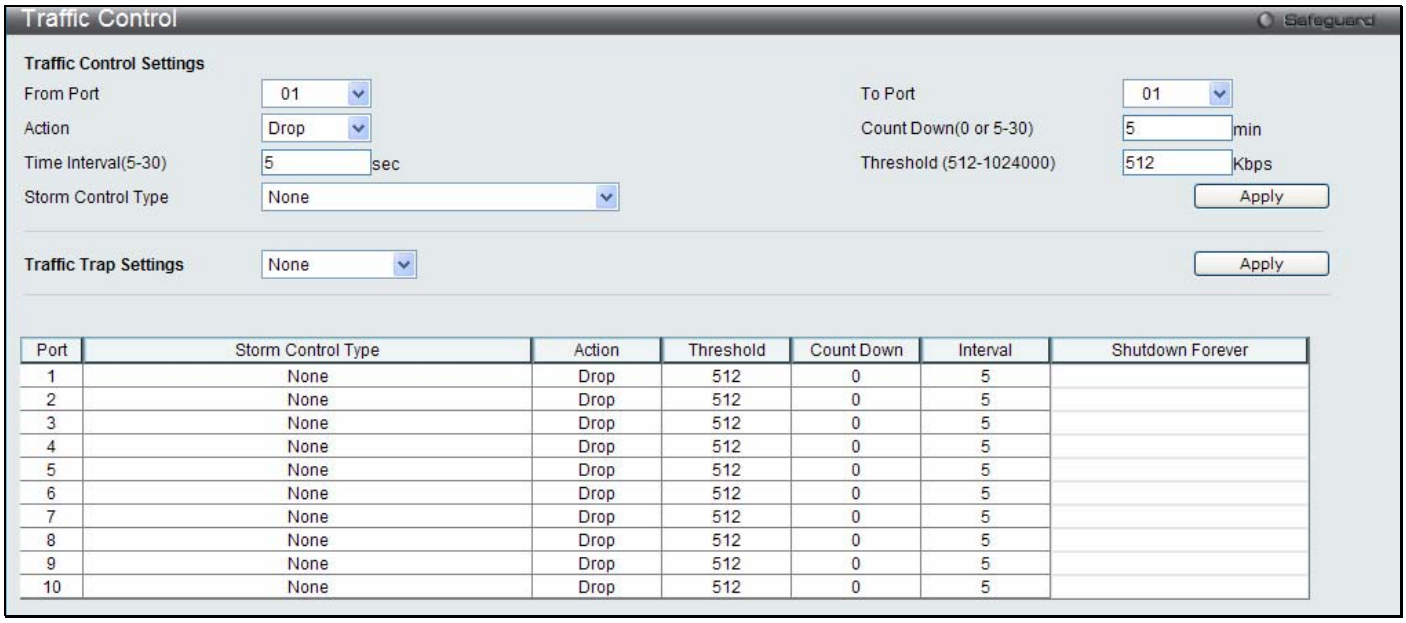

Traffic Control
Safeguard
Traffic Control Settings
From Port 01
To Port 01
Action Drop
Count Down(0 or 5-30) 5 min
Time Interval(5-30) 5 sec
Threshold (512-1024000) 512 Kbps
Storm Control Type None
Apply
Traffic Trap Settings None
Apply
Port | Storm Control Type | Action | Threshold | Count Down | Interval | Shutdown Forever
1 None Drop 512 0 5
2 None Drop 512 0 5
3 None Drop 512 0 5
4 None Drop 512 0 5
5 None Drop 512 0 5
6 None Drop 512 0 5
7 None Drop 512 0 5
8 None Drop 512 0 5
9 None Drop 512 0 5
10 None Drop 512 0 5

Figure 4 - 3. Traffic Control window

To configure Traffic Control, set the parameters described in the table below:

Parameter	Description
From Port	Select the beginning port of the range of port(s) to be configured.
To Port	Select the ending port of the range of port(s) to be configured.
Action	Select the method of traffic control from the pull-down menu. The choices are: *Drop* – Utilizes the hardware Traffic Control mechanism, which means the Switch's hardware will determine the Packet Storm based on the Threshold value stated and drop packets until the issue is resolved. *Shutdown* – Utilizes the Switch's software Traffic Control mechanism to determine the Packet Storm occurring. Once detected, the port will deny all incoming traffic to the port except STP BPDU packets, which are essential in keeping the Spanning Tree operational on the Switch. If the Count Down timer has expired and yet the Packet Storm continues, the port will be placed in Shutdown Forever mode

	and is no longer operational until the user manually resets the port using the **Port Settings** window (**Configuration** > **Port Configuration**> **Port Settings**). Choosing this option obligates the user to configure the Time Interval setting as well, which will provide packet count samplings from the Switch's chip to determine if a Packet Storm is occurring.
Count Down (0 or 5-30)	The Count Down timer is set to determine the amount of time, in minutes, that the Switch will wait before shutting down the port that is experiencing a traffic storm. This parameter is only useful for ports configured as *Shutdown* in their Action field and therefore will not operate for hardware-based Traffic Control implementations. The possible time settings for this field are *0* and *5* to *30* minutes.
Time Interval (5-30)	The Time Interval will set the time between Multicast and Broadcast packet counts sent from the Switch's chip to the Traffic Control function. These packet counts are the determining factor in deciding when incoming packets exceed the Threshold value. The Time Interval may be set between *5* and *30* seconds, with a default setting of *5* seconds.
Threshold (512-1024000)	Specifies the maximum number of packets per second that will trigger the Traffic Control function to commence. The configurable threshold range is from *512* to *1024000*, with a default setting of *512* Kbps.
Storm Control Type	Specifies the desired Storm Control Type: *None*, *Broadcast*, *Multicast*, *Unknown Unicast*, *Broadcast + Multicast*, *Broadcast + Unknown Unicast*, *Multicast + Unknown Unicast*, and *Broadcast + Multicast + Unknown Unicast*.
Traffic Trap Settings	Enable sending of Storm Trap messages when the type of action taken by the Traffic Control function in handling a Traffic Storm is one of the following: • *None* – Will send no Storm trap warning messages regardless of action taken by the Traffic Control mechanism. • *Storm Occurred* – Will send Storm Trap warning messages upon the occurrence of a Traffic Storm only. • *Storm Cleared* – Will send Storm Trap messages when a Traffic Storm has been cleared by the Switch only. • *Both* – Will send Storm Trap messages when a Traffic Storm has been both detected and cleared by the Switch. This function cannot be implemented in the hardware mode. (When *Drop* is chosen for the Action parameter.

Click **Apply** to implement the settings of each field.

NOTE: Traffic Control cannot be implemented on ports that are set for Link Aggregation (Port Trunking).

NOTE: Ports that are in the Shutdown Forever mode will be seen as Discarding in Spanning Tree windows and implementations though these ports will still be forwarding BPDUs to the Switch's CPU.

NOTE: Ports that are in Shutdown Forever mode will be seen as link down in all windows and screens until the user recovers these ports.

802.1p Default Priority

The Switch allows the assignment of a default 802.1p priority to each port on the Switch.

To view the following window, click **QoS** > **802.1p Default Priority**:

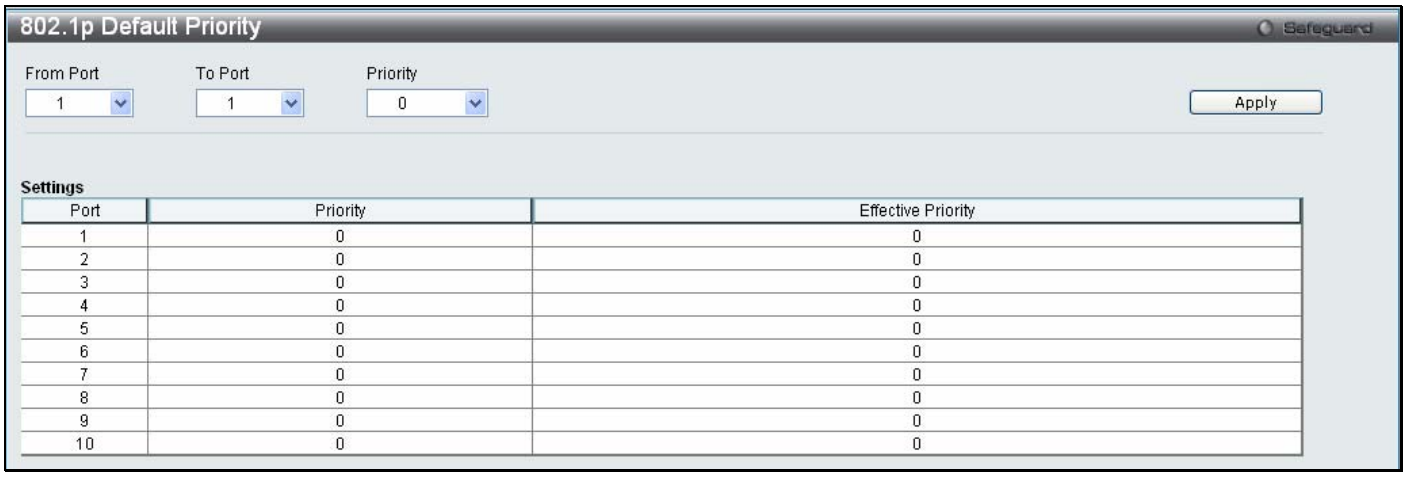


Figure 4 - 4. 802.1p Default Priority window

This page allows the user to assign a default 802.1p priority to any given port on the Switch. The priority and effective priority tags are numbered from *0*, the lowest priority, to *7*, the highest priority. The effective priority indicates the actual priority assigned by RADIUS. If the RADIUS assigned value exceedes the specified limit, the value will be set at the default priority. For example, if the RADIUS assigns a limit of 8 and the default priority is 0, the effective priority will be 0. To implement a new default priority, first choose a port range by using the From Port and To Port pull-down menus and then use the Priority drop-down menu to select a value from *0* to *7*. Click **Apply** to implement the settings.

802.1p User Priority

The Switch allows the assignment of a class of service to each of the 802.1p priorities.

To view the following window, click **QoS** > **802.1p User Priority**:

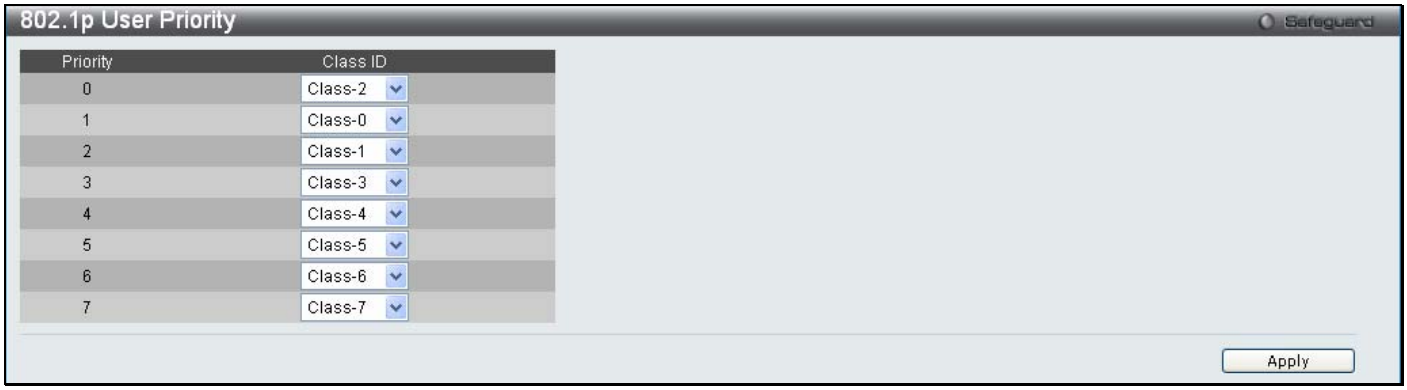


Figure 4 - 5. 802.1p User Priority window

Once a priority has been assigned to the port groups on the Switch, then a Class may be assigned to each of the eight levels of 802.1p priorities using the drop-down menus on this window. Click **Apply** to set the changes.

QoS Scheduling Mechanism

The Scheduling Mechanism drop-down menu allows a selection between a *Weight Fair* and a *Strict* mechanism for emptying the priority classes.

To view the following window, click **QoS** > **QoS Scheduling Mechanism**:

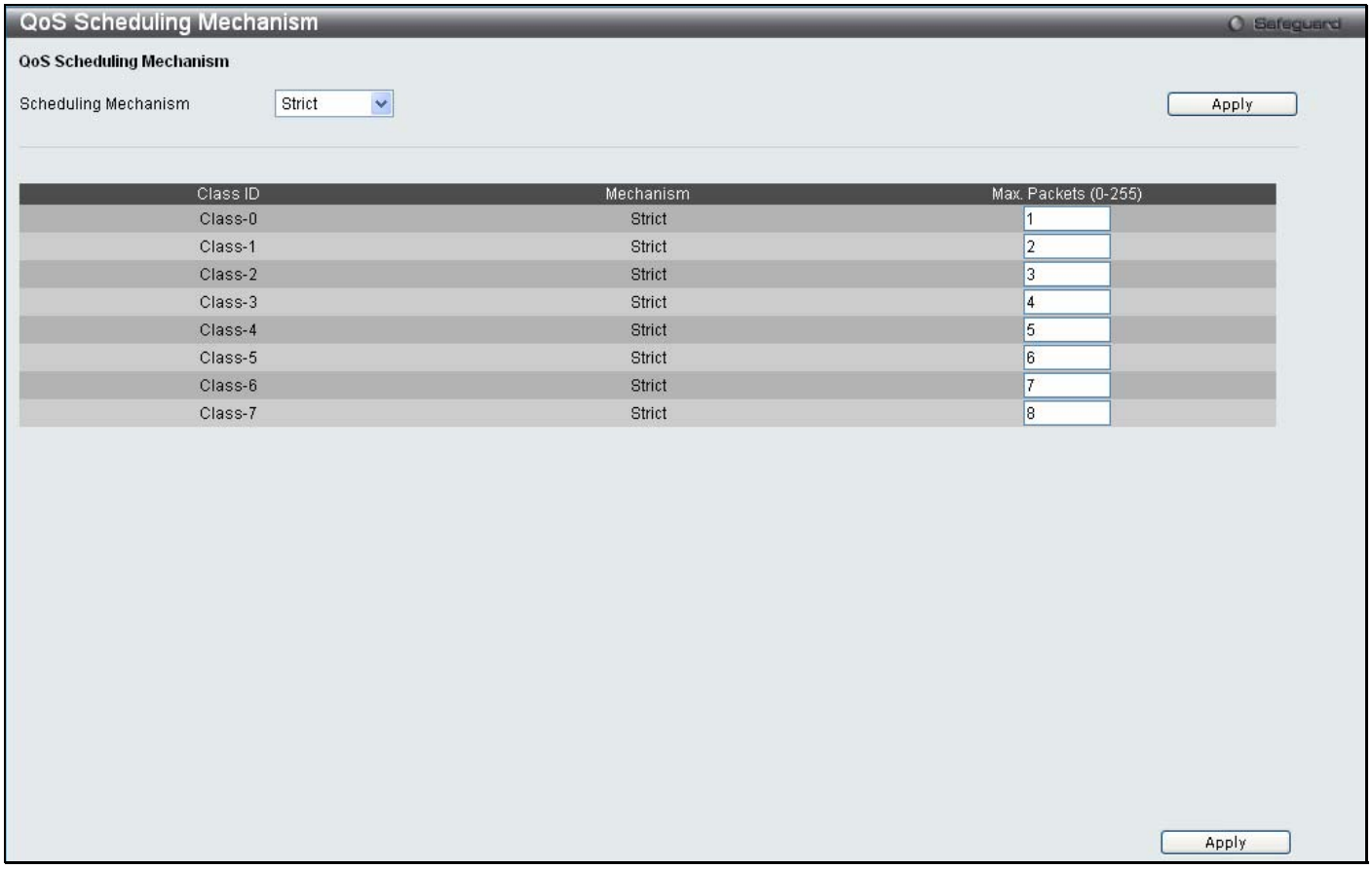


Figure 4 - 6. QoS Scheduling Mechanism window

The Scheduling Mechanism has the following parameters.

Parameter	Description
Strict	The highest class of service is the first to process traffic. That is, the highest class of service will finish before other queues empty.
Weight Fair	Use the weighted round-robin (*WRR*) algorithm to handle packets in an even distribution in priority classes of service.
Max. Packets (0-255)	Specifies the maximum number of packets the above specified hardware priority class of service will be allowed to transmit before allowing the next lowest priority queue to transmit its packets. A value between *0* and *255* can be specified.

Click **Apply** to allow changes to take effect.

Section 5

Security

Safeguard Engine

Trusted Host

IP-MAC-Port Binding

Port Security

DHCP Server Screening

Guest VLAN

802.1X

SSL Settings

SSH

Access Authentication Control

MAC Based Access Control

Web Authentication (Web-based Access Control)

JWAC

Multiple Authentication

IGMP Access Control Settings

Safeguard Engine

Periodically, malicious hosts on the network will attack the Switch by utilizing packet flooding (ARP Storm) or other methods. These attacks may increase the switch load beyond its capability. To alleviate this problem, the Safeguard Engine function was added to the Switch's software.

The Safeguard Engine can help the overall operability of the Switch by minimizing the workload of the Switch while the attack is ongoing, thus making it capable to forward essential packets over its network in a limited bandwidth. The Safeguard Engine has two operating modes that can be configured by the user, *Strict* and *Fuzzy*. In *Strict* mode, when the Switch either (a) receives too many packets to process or (b) exerts too much memory, it will enter the Exhausted mode. When in this mode, the Switch will drop all ARP and IP broadcast packets and packets from untrusted IP addresses for a calculated time interval. Every five seconds, the Safeguard Engine will check to see if there are too many packets flooding the Switch. If the threshold has been crossed, the Switch will initially stop all ingress ARP and IP broadcast packets and packets from untrusted IP addresses for five seconds. After another five-second checking interval arrives, the Switch will again check the ingress flow of packets. If the flooding has stopped, the Switch will again begin accepting all packets. Yet, if the checking shows that there continues to be too many packets flooding the Switch, it will stop accepting all ARP and IP broadcast packets and packets from untrusted IP addresses for double the time of the previous stop period. This doubling of time for stopping these packets will continue until the maximum time has been reached, which is 320 seconds and every stop from this point until a return to normal ingress flow would be 320 seconds. For a better understanding, please examine the following example of the Safeguard Engine.

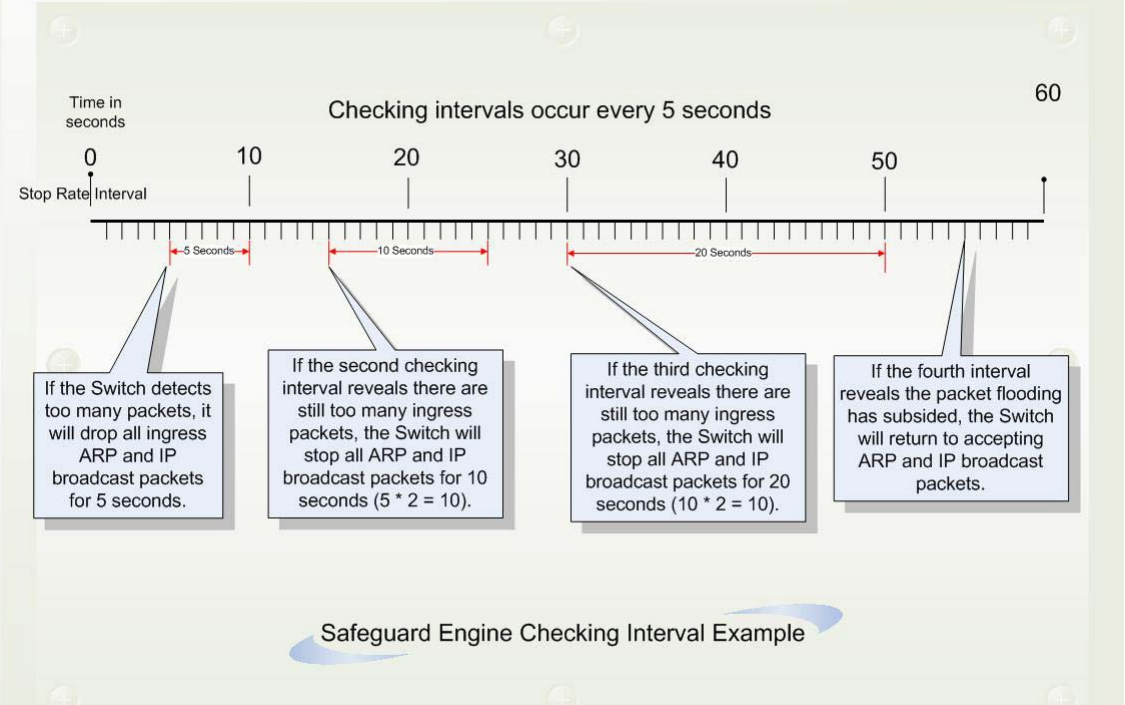

Time in seconds
Checking intervals occur every 5 seconds
60
0
10
20
30
40
50
Stop Rate Interval
5 Seconds
10 Seconds
20 Seconds
If the Switch detects too many packets, it will drop all ingress ARP and IP broadcast packets for 5 seconds.
If the second checking interval reveals there are still too many ingress packets, the Switch will stop all ARP and IP broadcast packets for 10 seconds (5 * 2 = 10).
If the third checking interval reveals there are still too many ingress packets, the Switch will stop all ARP and IP broadcast packets for 20 seconds (10 * 2 = 10).
If the fourth interval reveals the packet flooding has subsided, the Switch will return to accepting ARP and IP broadcast packets.
Safeguard Engine Checking Interval Example

Figure 5 - 1. Safeguard Engine example

For every consecutive checking interval that reveals a packet flooding issue, the Switch will double the time it will discard ingress ARP and IP broadcast packets and packets from untrusted IP addresses. In the example above, the Switch doubled the time for dropping ARP and IP broadcast packets when consecutive flooding issues were detected at 5-second intervals. (First stop = 5 seconds, second stop = 10 seconds, third stop = 20 seconds) Once the flooding is no longer detected, the wait period for dropping ARP and IP broadcast packets will return to 5 seconds and the process will resume.

In *Fuzzy* mode, once the Safeguard Engine has entered the Exhausted mode, the Safeguard Engine will decrease the packet flow by half. After returning to Normal mode, the packet flow will be increased by 25%. The switch will then return to its interval checking and dynamically adjust the packet flow to avoid overload of the Switch.

NOTICE: When Safeguard Engine is enabled, the Switch will allot bandwidth to various traffic flows (ARP, IP) using the FFP (Fast Filter Processor) metering table to control the CPU utilization and limit traffic. This may limit the speed of routing traffic over the network.

Users can enable the Safeguard Engine or configure advanced Safeguard Engine settings for the Switch.

To view the following window, click **Security > Safeguard Engine**:

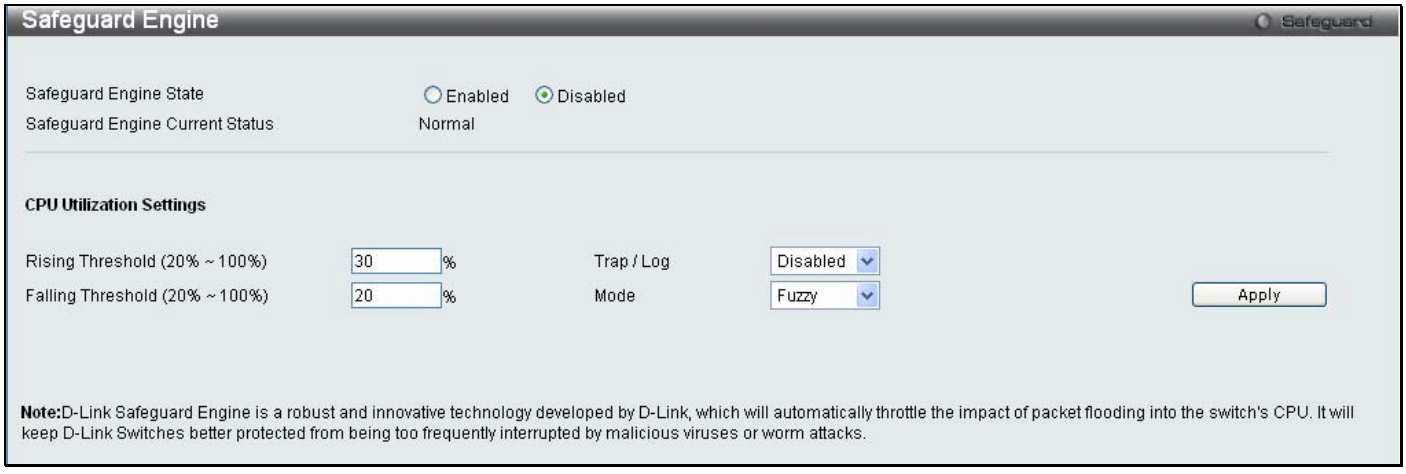

Safeguard Engine
Safeguard
Safeguard Engine State
Enabled
Disabled
Safeguard Engine Current Status
Normal
CPU Utilization Settings
Rising Threshold (20% ~ 100%)
30
%
Trap / Log
Disabled
Falling Threshold (20% ~ 100%)
20
%
Mode
Fuzzy
Apply
Note:D-Link Safeguard Engine is a robust and innovative technology developed by D-Link, which will automatically throttle the impact of packet flooding into the switch's CPU. It will keep D-Link Switches better protected from being too frequently interrupted by malicious viruses or worm attacks.

Figure 5 - 2. Safeguard Engine window

To enable the Safeguard Engine option, click the Enabled radio button next to Safeguard Engine State at the top of the window.

To configure the advanced settings for the Safeguard Engine, set the following parameters and click **Apply**.

Parameter	Description
Safeguard Engine State	Use the radio button to globally enable or disable Safeguard Engine settings for the Switch.
Rising Threshold (20% - 100%)	Used to configure the acceptable level of CPU utilization before the Safeguard Engine mechanism is enabled. Once the CPU utilization reaches this percentage level, the Switch will move into Exhausted mode, based on the parameters provided in this window.
Falling Threshold (20% - 100%)	Used to configure the acceptable level of CPU utilization as a percentage, where the Switch leaves the Safeguard Engine state and returns to normal mode.
Trap / Log	Use the pull-down menu to enable or disable the sending of messages to the device's SNMP agent and switch log once the Safeguard Engine has been activated by a high CPU utilization rate.
Mode	Used to select the type of Safeguard Engine to be activated by the Switch when the CPU utilization reaches a high rate. The user may select: *Fuzzy* – If selected, this function will instruct the Switch to minimize the IP and ARP traffic flow to the CPU by dynamically allotting an even bandwidth to all traffic flows. *Strict* – If selected, this function will stop accepting all ARP packets not intended for the Switch, and will stop receiving all unnecessary broadcast IP packets, until the storm has subsided. The default setting is *Fuzzy* mode.

Trusted Host

Up to ten trusted host secure IP addresses may be configured and used for remote Switch management. It should be noted that if one or more trusted hosts are enabled, the Switch will immediately accept remote instructions from only the specified IP address or addresses. If you enable this feature, be sure to first enter the IP address of the station you are currently using.

To view the following window, click **Security > Trusted Host**:

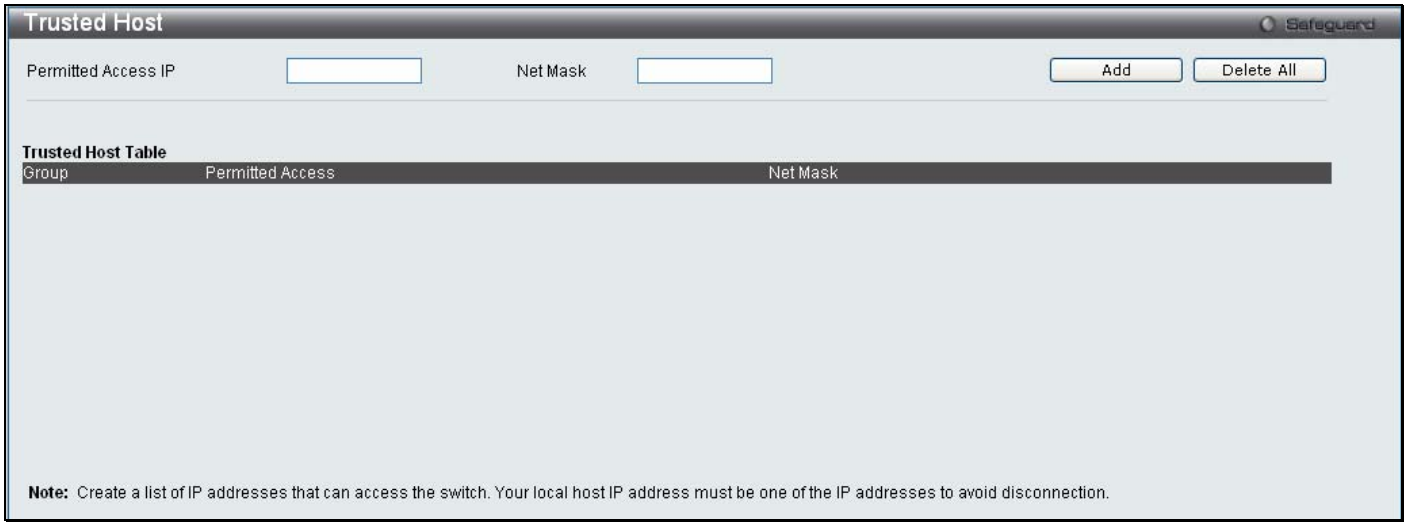

Trusted Host
Safeguard
Permitted Access IP
Net Mask
Add
Delete All
Trusted Host Table
Group
Permitted Access
Net Mask
Note: Create a list of IP addresses that can access the switch. Your local host IP address must be one of the IP addresses to avoid disconnection.

Figure 5 - 3. Trusted Host window

To configure secure IP addresses for trusted host management of the Switch, type the IP address and the net mask of the station you are currently using in the two fields, as well as up to nine additional IP addresses of trusted hosts, one by one. Click the **Apply** button to assign trusted host status to the IP addresses. This goes into effect immediately.

IP-MAC-Port Binding

The IP network layer uses a four-byte address. The Ethernet link layer uses a six-byte MAC address. Binding these two address types together allows the transmission of data between the layers. The primary purpose of IP-MAC-port binding is to restrict the access to a switch to a number of authorized users. Authorized clients can access a switch's port by either checking the pair of IP-MAC addresses with the pre-configured database or if DHCP snooping has been enabled in which case the the switch will automatically learn the IP/MAC pairs by snooping DHCP packets and saving them to the IMPB white list. If an unauthorized user tries to access an IP-MAC binding enabled port, the system will block the access by dropping its packet. For the xStack® DGS-3200 Series of switches, active and inactive entries use the same database. The maximum number of entries is 511. The creation of authorized users can be manually configured by CLI or Web. The function is port-based, meaning a user can enable or disable the function on the individual port.

The **IP-MAC-Port Binding** folder contains five windows: **IMP Global Settings**, **IMP Port Settings**, **IMP Entry Settings**, **DHCP Snooping Entries**, and **MAC Block List**.

IMP Global Settings

Users can enable or disable the Trap/Log State and DHCP Snoop state on the Switch. The Trap/Log field will enable and disable the sending of trap/log messages for IP-MAC-port binding. When enabled, the Switch will send a trap message to the SNMP agent and the Switch log when an ARP packet is received that doesn't match the IP-MAC-port binding configuration set on the Switch.

To view the following window, click **Security** > **IP-MAC-Port Binding** > **IMP Global Settings**:

Figure 5 - 4. IMP Global Settings window

The following parameters can be set:

Parameter	Description
Trap / Log	This field will enable and disable the sending of trap/log messages for IP-MAC-port binding. When *Enabled*, the Switch will send a trap message to the SNMP agent and the Switch log when an ARP packet is received that doesn't match the IP-MAC-port binding configuration set on the Switch. The default is *Disabled*.
DHCP Snoop State	Use the pull-down menu to enable or disable DHCP snooping for IP-MAC-port binding. The default is *Disabled*.

Click **Apply** to implement the settings made.

IMP Port Settings

Select a port or a range of ports with the From Port and To Port fields. Enable or disable the port with the State, Allow Zero IP and Forward DHCP Packet field, and configure the port's Max Entry.

To view the following window, click **Security** > **IP-MAC-Port Binding** > **IMP Port Settings**:

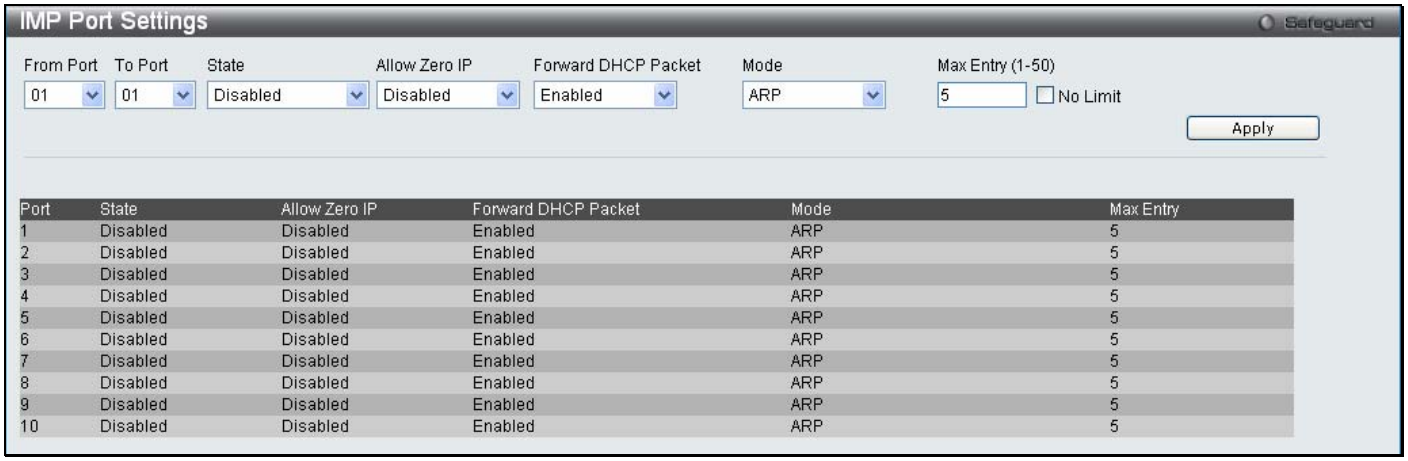


Figure 5 - 5. IMP Port Settings window

The following fields can be set or modified:

Parameter	Description
From Port/To Port	Select a range of ports to set for IP-MAC-port binding.
State	Use the pull-down menu to enable or disable these ports for IP-MAC-port binding.
Enabled (Strict)	This mode provides a stricter method of control. If the user selects this mode, all packets will be sent to the CPU, thus all packets will not be forwarded by the hardware until the S/W learns the entries for the ports. The port will check ARP packets and IP packets by IP-MAC-port binding entries. When the packet is found by the entry, the MAC address will be set to dynamic state. If the packet is not found by the entry, the MAC address will be set to block. Other packets will be dropped. The default mode is strict if not specified. The ports with strict mode will capture unicast DHCP packets through the ACL module. If configuring IP-MAC-port binding in strict mode when IP-MAC-port binding DHCP snooping is enabled, it will create an ACL profile and the rules according to the ports. If there is not enough profile or rule space for an ACL profile or rule table, it will return a warning message and will not create an ACL profile and rules to capture unicast DHCP packets.
Enabled (Loose)	This mode provides a looser way of control. If the user selects loose mode, ARP packets and IP broadcast packets will be sent to the CPU. The packets will still be forwarded by the hardware until a specific source MAC address is blocked by the software. The port will check ARP packets and IP broadcast packets by IP-MAC-port binding entries. When the packet is found by the entry, the MAC address will be set to dynamic state. If the packet is not found by the entry, the MAC address will be set to block. Other packets will be bypassed.
Allow Zero IP	Use the pull-down menu to enable or disable this feature. Allow zero IP configures the state which allows ARP packets with 0.0.0.0 source IP to bypass.
Forward DHCP Packet	By default, the DHCP packet with broadcast DA will be flooded. When set to disable, the broadcast DHCP packet received by the specified port will not be forwarded in strict mode. This setting is effective when DHCP snooping is enabled, in the case when a DHCP packet which has been trapped by the CPU needs to be forwarded by the software. This setting controls the forwarding behavior in this situation.
Mode	Toggle between *ARP* and *ACL*. When configuring the port mode to ACL, the Switch will create an ACL access entry corresponding to the entries of this port. If the port changes to ARP, all the ACL access entries will be deleted automatically. The default mode is *ARP*.
Max Entry (1-50)	Specifies the maximum number of DHCP snooping entries. By default, the per port maximum entry is *5*.

Click **Apply** to implement the settings made.

IMP Entry Settings

This table is used to create static IP-MAC-binding port entries and view all IMP entries on the Switch. Click **Find** to search for an entry. Click **View All** for the table to display all entries and click **Delete All** to remove all static entries.

To view the following window, click **Security > IP-MAC-Port Binding > IMP Entry Settings**:

Figure 5 - 6. IMP Entry Settings window

The following fields can be set or modified:

Parameter	Description
IP Address	Enter the IP address to bind to the MAC address set below.
MAC Address	Enter the MAC address to bind to the IP Address set above.
Mode	Static or Auto will be displayed in this column.
Ports	Specify the switch ports for which to configure this IP-MAC binding entry (IP Address + MAC Address). Click the All check box to configure this entry for all ports on the Switch.

Click **Apply** to implement changes. Click **Find** to search for an entry. Click **Show All** for the table to display all entries or **Delete All** to remove all the static entries.

DHCP Snooping Entries

This table is used to view dynamic entries on specific ports. To view particular port settings, enter the port number and click **Find**. To view all entries click **View All**, and to delete an entry, click **Clear**.

To view the following window, click **Security > IP-MAC-Port Binding > DHCP Snooping Entries**:

Figure 5 - 7. DHCP Snooping Entries window

The following fields can be set or modified:

Parameter	Description
Port	Use the drop-down menu to select the desired port.
Ports (e.g.: 1, 7-12)	Specify the ports for which to view DHCP snooping entries. Tick the All check box to configure this entry for all ports on the Switch.

Click **Apply** to implement changes.

MAC Block List

This table is used to view unauthorized devices that have been blocked by IP-MAC binding restrictions. To find an unauthorized device that has been blocked by the IP-MAC binding restrictions, enter the VID and MAC Address in the appropriate fields and click **Find**. To delete an entry, click the **Delete** button next to the entry's port. To delete all the entries in the window, click **Delete All**. Click **View All** for the table to display all entries.

To view the following window, click **Security > IP-MAC-Port Binding > MAC Block List**:

Figure 5 - 8. MAC Block List window

The following fields can be set or modified:

Parameter	Description
VID	Enter a VLAN ID number.
MAC Address	Enter a MAC address.

Click **Apply** to implement changes.

Port Security

The **Port Security** folder contains two windows: **Port Security Settings** and **Port Lock Entries**.

Port Security Settings

A given port's (or a range of ports') dynamic MAC address learning can be locked such that the current source MAC addresses entered into the MAC address forwarding table can not be changed once the port lock is enabled. The port can be locked by changing the Admin State pull-down menu to *Enabled* and clicking **Apply**.

Port Security is a security feature that prevents unauthorized computers (with source MAC addresses) unknown to the Switch prior to locking the port (or ports) from connecting to the Switch's locked ports and gaining access to the network.

To view the following window, click **Security > Port Security > Port Security Settings**:

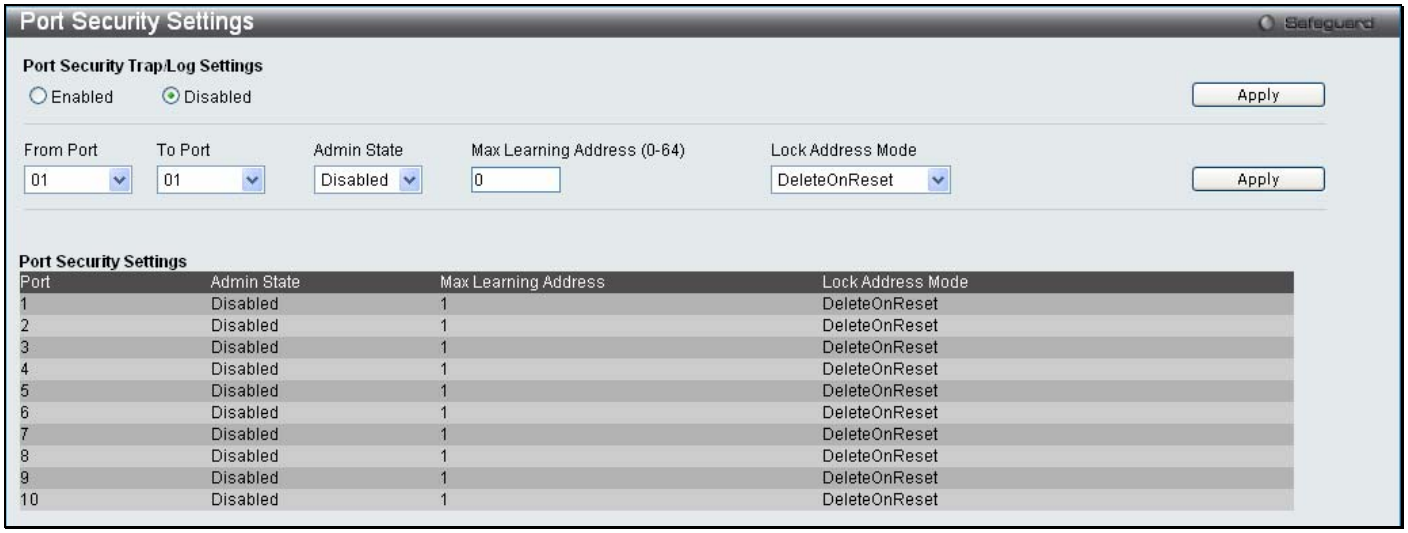


Figure 5 - 9. Port Security Settings window

The following parameters can be set:

Parameter	Description
Port Security Trap/ Log Settings	Use the radio button to enable or disable Port Security Traps and Log Settings on the Switch.
From Port	The beginning port of a consecutive group of ports to be configured.
To Port	The ending port of a consecutive group of ports to be configured.
Admin State	This pull-down menu allows the user to enable or disable Port Security (locked MAC address table for the selected ports).
Max Learning Address (0-64)	The number of MAC addresses that will be in the MAC address forwarding table for the selected switch and group of ports.
Lock Address Mode	This pull-down menu allows the option of how the MAC address table locking will be implemented on the Switch, for the selected group of ports. The options are: *Permanent* – The locked addresses will only age out after the Switch has been reset. *DeleteOnTimeout* – The locked addresses will age out after the aging timer expires. *DeleteOnReset* – The locked addresses will not age out until the Switch has been reset or rebooted.

Click **Apply** to implement changes made.

Port Lock Entries

Users can remove an entry from the port security entries learned by the Switch and entered into the forwarding database.

To view the following window, click **Security > Port Security > Port Lock Entries**:

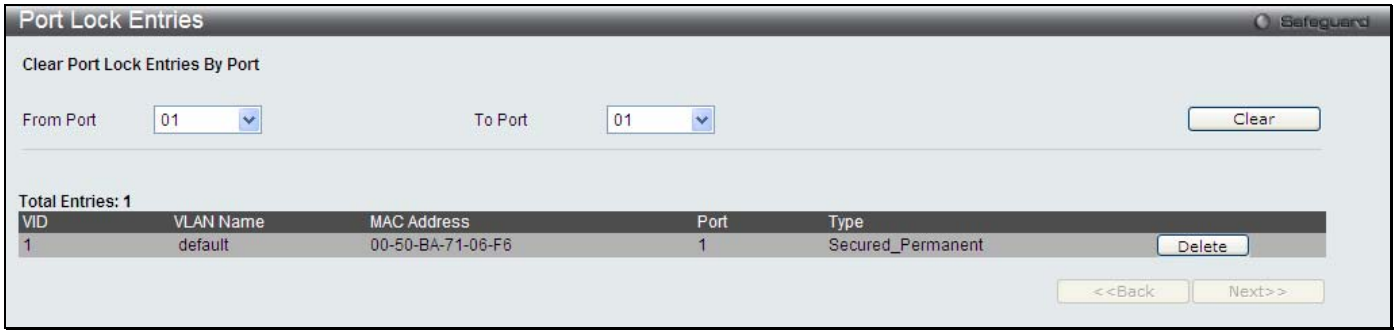


Figure 5 - 10. Port Lock Entries window

This function is only operable if the Mode in the **Port Security** window is selected as *Permanent* or *DeleteOnReset*, or in other words, only addresses that are statically learned by the Switch can be deleted. Once the entry has been defined by entering the correct information into the window above, click the **Delete** button of the corresponding MAC address to be deleted. Click the **Next** button to view the next page of entries listed in this table.

This window displays the following information:

Parameter	Description
VID	The VLAN ID of the entry in the forwarding database table that has been permanently learned by the Switch.
VLAN Name	The VLAN Name of the entry in the forwarding database table that has been permanently learned by the Switch.
MAC Address	The MAC address of the entry in the forwarding database table that has been permanently learned by the Switch.
Port	The ID number of the port that has permanently learned the MAC address.
Type	The type of MAC address in the forwarding database table. Only entries marked Permanent or Delete on Reset can be deleted.
Delete	Click the **Delete** button to remove the corresponding MAC address that was permanently learned by the Switch.

DHCP Server Screening

The **DHCP Server Screening** folder contains two windows: **DHCP Screening Port Settings** and **DHCP Offer Filtering**.

DHCP Screening Port Settings

The Switch supports DHCP Server Screening, a feature that denies access to rogue DHCP servers.

When the DHCP server filter function is enabled, all DHCP server packets will be filtered from a specific port.

To view the following window, click **Security > DHCP Server Screening > DHCP Screening Port Settings**:

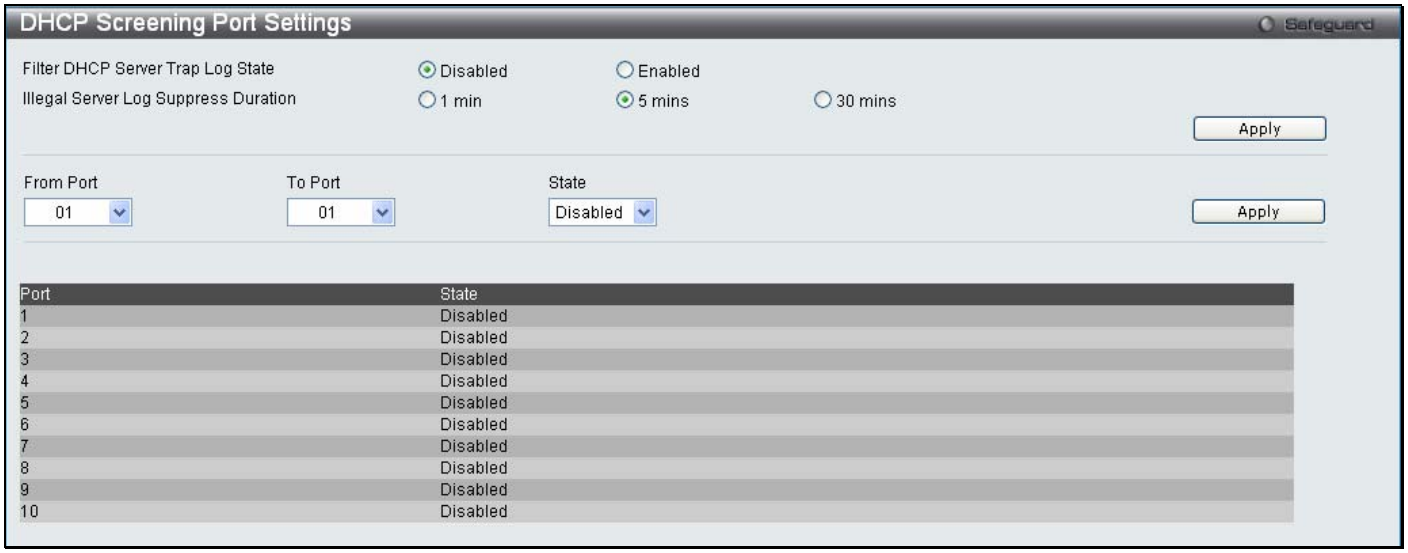


Figure 5 - 11. DHCP Screening Port Settings window

The user may set the following parameters:

Parameter	Description
From DHCP Server Trap Log State	Enable or disable this feature.
Illegal Server Log Suppress Duration	Choose an illegal server log suppress duration of 1 minute, 5 minutes, or 30 minutes.
From Port/To Port	A consecutive group of ports may be configured starting with the selected port.
State	Choose *Enabled* to enable the DHCP server screening or *Disabled* to disable it. The default is *Disabled*.

After setting the previous parameters, click **Apply** to allow your changes to be implemented.

DHCP Offer Filtering

This function allows the user to not only restrict all DHCP Server packets but also to receive any specified DHCP server packet by any specified DHCP client, it is useful when one or more DHCP servers are present on the network and both provide DHCP services to different distinct groups of clients. The first time the DHCP filter is enabled it will create both an access profile entry and an access rule per port entry, it will also create other access rules. These rules are used to block all DHCP server packets. In addition to a permit DHCP entry, it will also create one access profile and one access rule entry the first time the DHCP client MAC address is used as the client MAC address. The Source IP address is the same as the DHCP server's IP address (UDP source port number 67). These rules are used to permit the DHCP server packets with specific fields, which the user has configured.

To view the following window, click **Security > DHCP Server Screening > DHCP Offer Filtering**:

Figure 5 - 12. DHCP Offer Filtering window

The user may set the following parameters:

Parameter	Description
Server IP Address	The IP address of the DHCP server to be filtered.
Client's MAC Address	The MAC address of the DHCP client. Only multiple legal DHCP servers on the network need to be entered in this field. If there is only one iegal DHCP server on the network, no input to this field is allowed.
Ports	The port numbers of the filter DHCP server.

After setting the previous parameters, click **Apply** to allow your changes to be implemented.

Guest VLAN

On 802.1X security-enabled networks, there is a need for non-802.1X supported devices to gain limited access to the network, due to lack of the proper 802.1X software or incompatible devices, such as computers running Windows 98 or older operating systems, or the need for guests to gain access to the network without full authorization or local authentication on the Switch. To supplement these circumstances, this switch now implements 802.1X Guest VLANs. These VLANs should have limited access rights and features separate from other VLANs on the network.

To implement 802.1X Guest VLANs, the user must first create a VLAN on the network with limited rights and then enable it as an 802.1X guest VLAN. Then the administrator must configure the guest accounts accessing the Switch to be placed in a Guest VLAN when trying to access the Switch. Upon initial entry to the Switch, the client wishing services on the Switch will need to be authenticated by a remote RADIUS Server or local authentication on the Switch to be placed in a fully operational VLAN. If authenticated and the authenticator posseses the VLAN placement information, that client will be accepted into the fully operational target VLAN and normal switch functions will be open to the client. If the authenticator does not have target VLAN placement information, the client will be returned to its originating VLAN. Yet, if the client is denied authentication by the authenticator, it will be placed in the Guest VLAN where it has limited rights and access. The adjacent figure should give the user a better understanding of the Guest VLAN process.

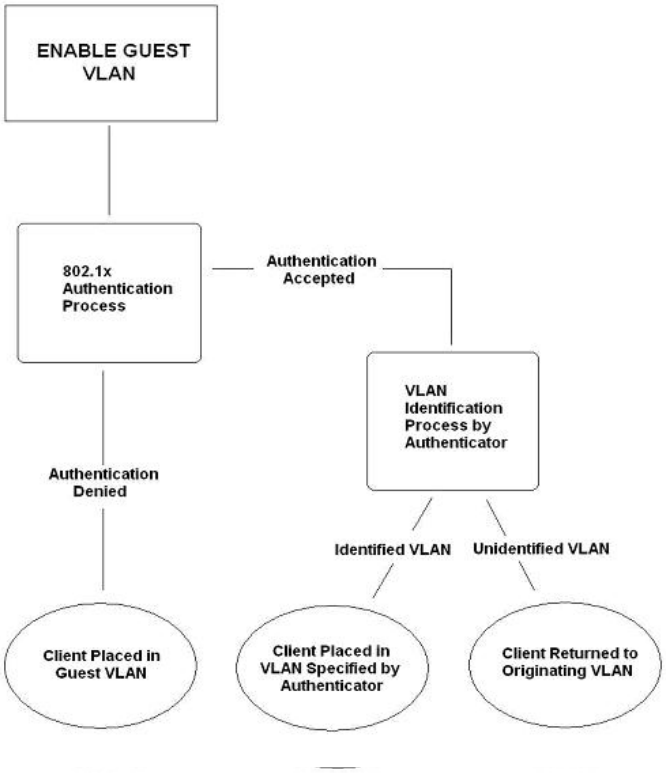


Figure 5- 13. Guest VLAN Authentication Process

Limitations Using the Guest VLAN

1. Ports supporting Guest VLANs cannot be GVRP enabled and vice versa.
2. A port cannot be a member of a Guest VLAN and a static VLAN simultaneously.
3. Once a client has been accepted into the target VLAN, it can no longer access the Guest VLAN.
4. If a port is a member of multiple VLANs, it cannot become a member of the Guest VLAN.

To view the following window, click **Security** > **Guest VLAN**:

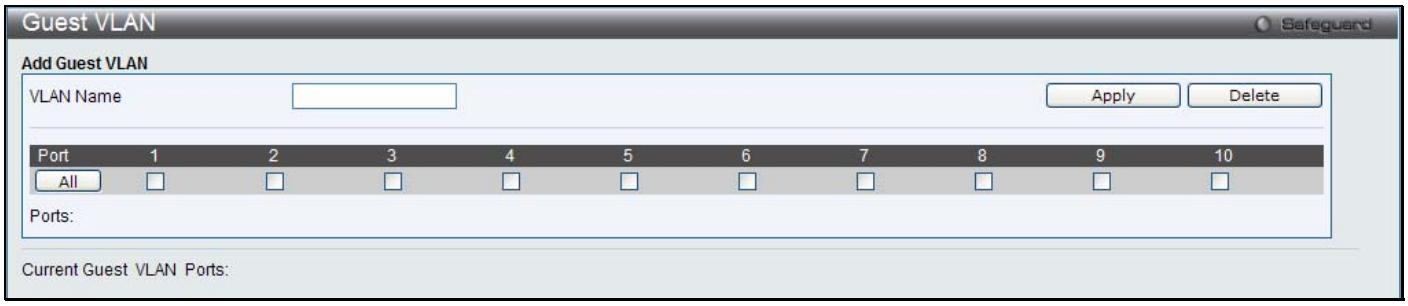


Figure 5 - 14. Guest VLAN window

Remember, to set an 802.1X guest VLAN, the user must first configure a normal VLAN, which can be enabled here for guest VLAN status.

The following fields may be modified to enable the 802.1X guest VLAN:

Parameter	Description
VLAN Name	Enter the pre-configured VLAN name to create as an 802.1X guest VLAN.
Port	Set the ports to be enabled for the 802.1X guest VLAN.

Click **Apply** to implement the 802.1X guest VLAN settings entered. Only one VLAN may be assigned as the 802.1X guest VLAN.

802.1X (Port-Based and Host-Based Access Control)

The IEEE 802.1X standard is a security measure for authorizing and authenticating users to gain access to various wired or wireless devices on a specified Local Area Network by using a Client and Server based access control model. This is accomplished by using a RADIUS server to authenticate users trying to access a network by relaying Extensible Authentication Protocol over LAN (EAPOL) packets between the Client and the Server. The following figure represents a basic EAPOL packet:

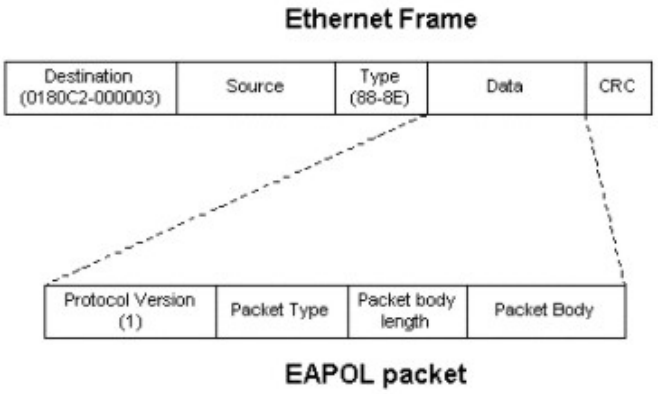


Figure 5 - 15. The EAPOL Packet

Utilizing this method, unauthorized devices are restricted from connecting to a LAN through a port to which the user is connected. EAPOL packets are the only traffic that can be transmitted through the specific port until authorization is granted. The 802.1X Access Control method has three roles, each of which are vital to creating and upkeeping a stable and working Access Control security method.

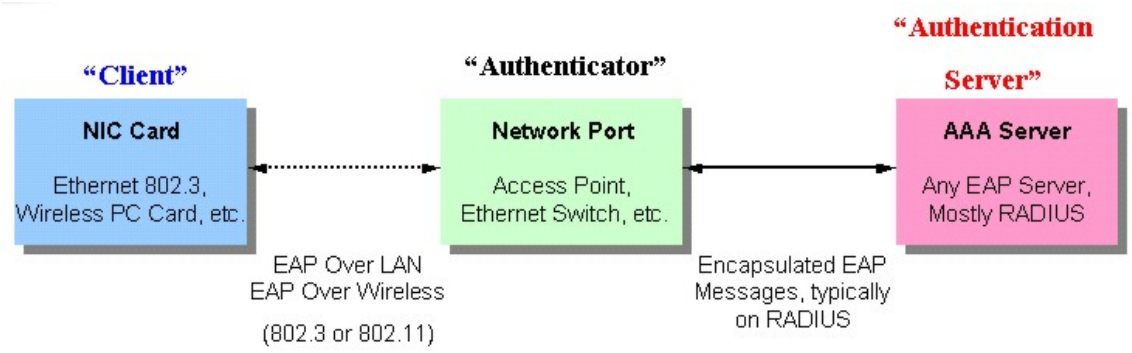


Figure 5 - 16. The three roles of 802.1X

The following section will explain the three roles of Client, Authenticator and Authentication Server in greater detail.

Authentication Server

The Authentication Server is a remote device that is connected to the same network as the Client and Authenticator, must be running a RADIUS Server program and must be configured properly on the Authenticator (Switch). Clients connected to a port on the Switch must be authenticated by the Authentication Server (RADIUS) before attaining any services offered by the Switch on the LAN. The role of the Authentication Server is to certify the identity of the Client attempting to access the network by exchanging secure information between the RADIUS server and the Client through EAPOL packets and, in turn, informs the Switch whether or not the Client is granted access to the LAN and/or switches services.

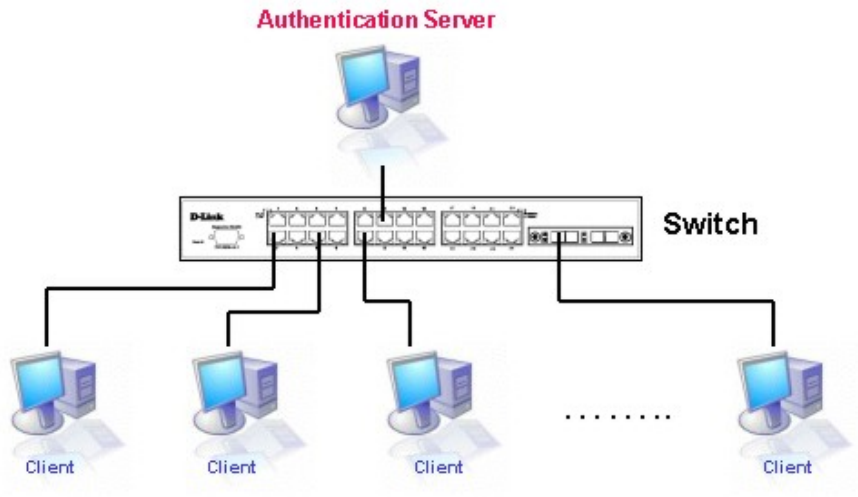


Figure 5 - 17. The Authentication Server

Authenticator

The Authenticator (the Switch) is an intermediary between the Authentication Server and the Client. The Authenticator serves two purposes when utilizing the 802.1X function. The first purpose is to request certification information from the Client through EAPOL packets, which is the only information allowed to pass through the Authenticator before access is granted to the Client. The second purpose of the Authenticator is to verify the information gathered from the Client with the Authentication Server, and to then relay that information back to the Client.

Three steps must be implemented on the Switch to properly configure the Authenticator.

1. The 802.1X State must be *Enabled*. (**Security / 802.1X /802.1X Settings**)
2. The 802.1X settings must be implemented by port (**Security / 802.1X / 802.1X Settings**)
3. A RADIUS server must be configured on the Switch. (**Security / 802.1X / Authentic RADIUS Server**)

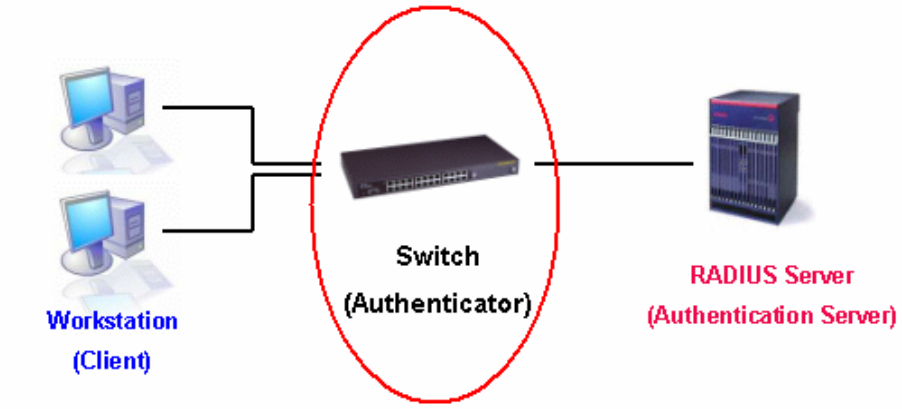


Figure 5 - 18. The Authenticator

Client

The Client is simply the endstation that wishes to gain access to the LAN or switch services. All endstations must be running software that is compliant with the 802.1X protocol. For users running Windows XP and Windows Vista, that software is included within the operating system. All other users are required to attain 802.1X client software from an outside source. The Client will request access to the LAN and or Switch through EAPOL packets and, in turn will respond to requests from the Switch.

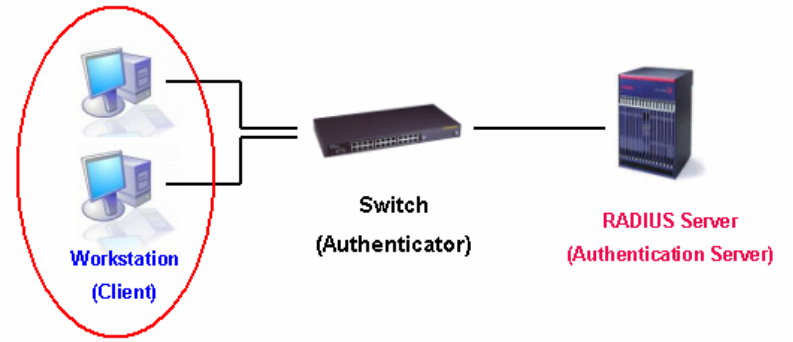


Figure 5 - 19. The Client

Authentication Process

Utilizing the three roles stated above, the 802.1X protocol provides a stable and secure way of authorizing and authenticating users attempting to access the network. Only EAPOL traffic is allowed to pass through the specified port before a successful authentication is made. This port is "locked" until the point when a Client with the correct username and password (and MAC address if 802.1X is enabled by MAC address) is granted access and therefore successfully "unlocks" the port. Once unlocked, normal traffic is allowed to pass through the port. The following figure displays a more detailed explanation of how the authentication process is completed between the three roles stated above.

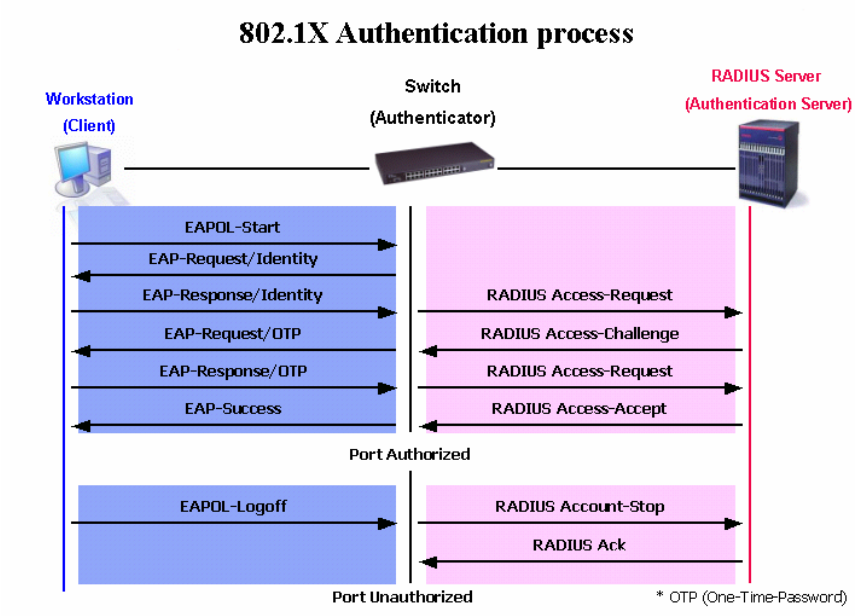


Figure 5 - 20. The 802.1X Authentication Process

The D-Link implementation of 802.1X allows network administrators to choose between two types of Access Control used on the Switch, which are:

1. Port-Based Access Control – This method requires only one user to be authenticated per port by a remote RADIUS server to allow the remaining users on the same port access to the network.
2. Host-Based Access Control – Using this method, the Switch will automatically learn up to sixteen MAC addresses by port and set them in a list. Each MAC address must be authenticated by the Switch using a remote RADIUS server before being allowed access to the Network.

Understanding 802.1X Port-based and Host-based Network Access Control

The original intent behind the development of 802.1X was to leverage the characteristics of point-to-point in LANs. As any single LAN segment in such infrastructures has no more than two devices attached to it, one of which is a Bridge Port. The Bridge Port detects events that indicate the attachment of an active device at the remote end of the link, or an active device becoming inactive. These events can be used to control the authorization state of the Port and initiate the process of authenticating the attached device if the Port is unauthorized. This is the Port-Based Network Access Control.

Port-Based Network Access Control

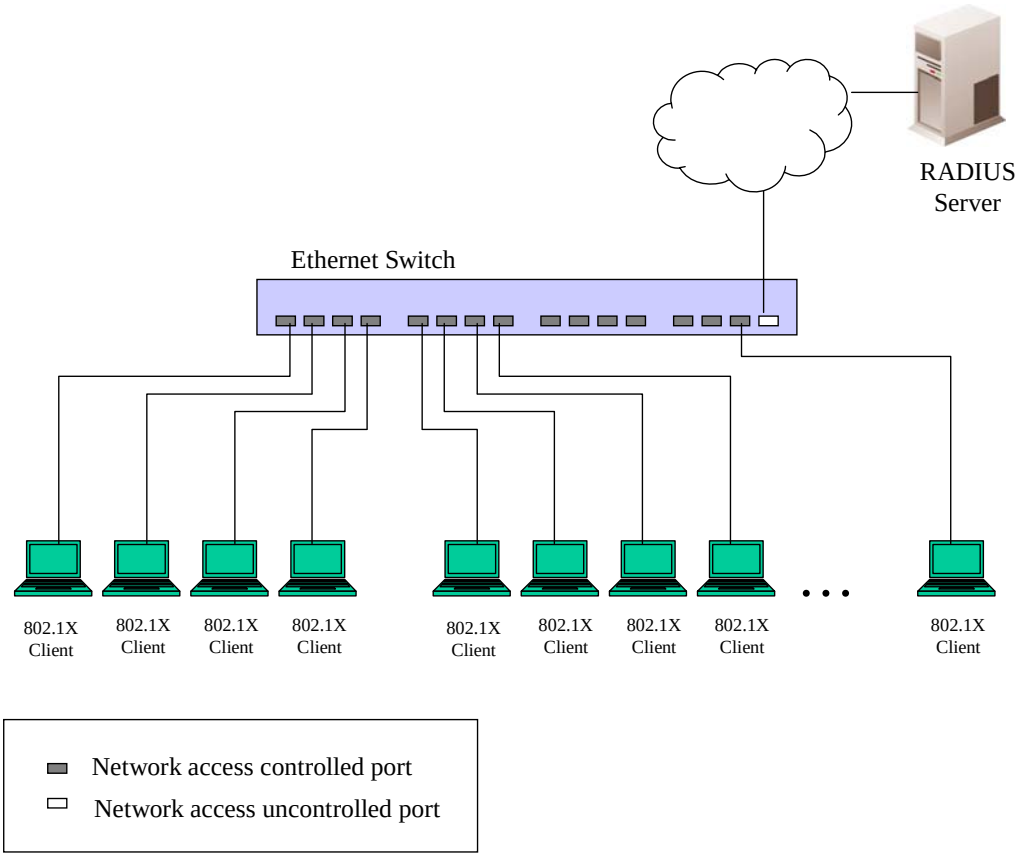


Figure 5 - 21. Example of Typical Port-Based Configuration

Once the connected device has successfully been authenticated, the Port then becomes Authorized, and all subsequent traffic on the Port is not subject to access control restriction until an event occurs that causes the Port to become Unauthorized. Hence, if the Port is actually connected to a shared media LAN segment with more than one attached device, successfully authenticating one of the attached devices effectively provides access to the LAN for all devices on the shared segment. Clearly, the security offered in this situation is open to attack.

Host-Based Network Access Control

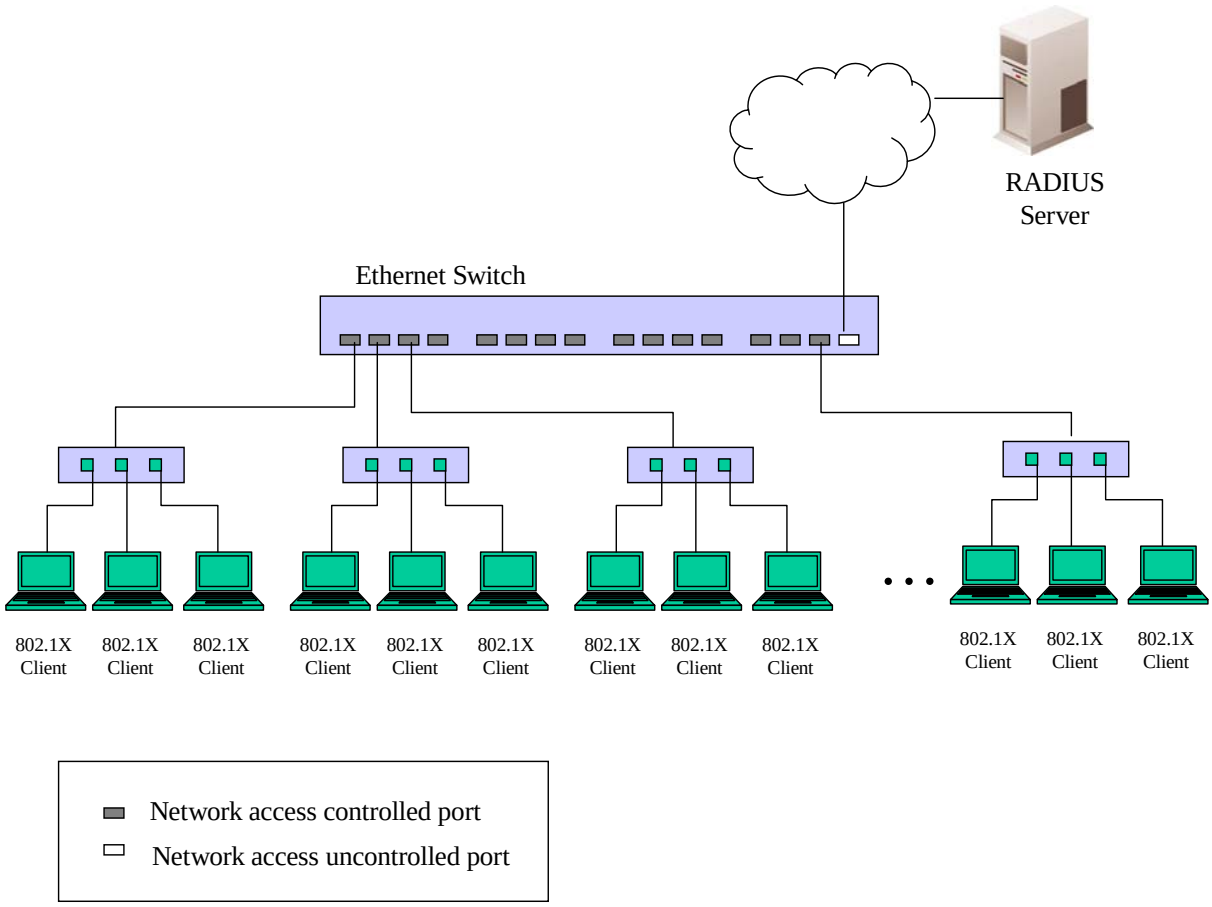


Figure 5 - 22. Example of Typical Host-Based Configuration

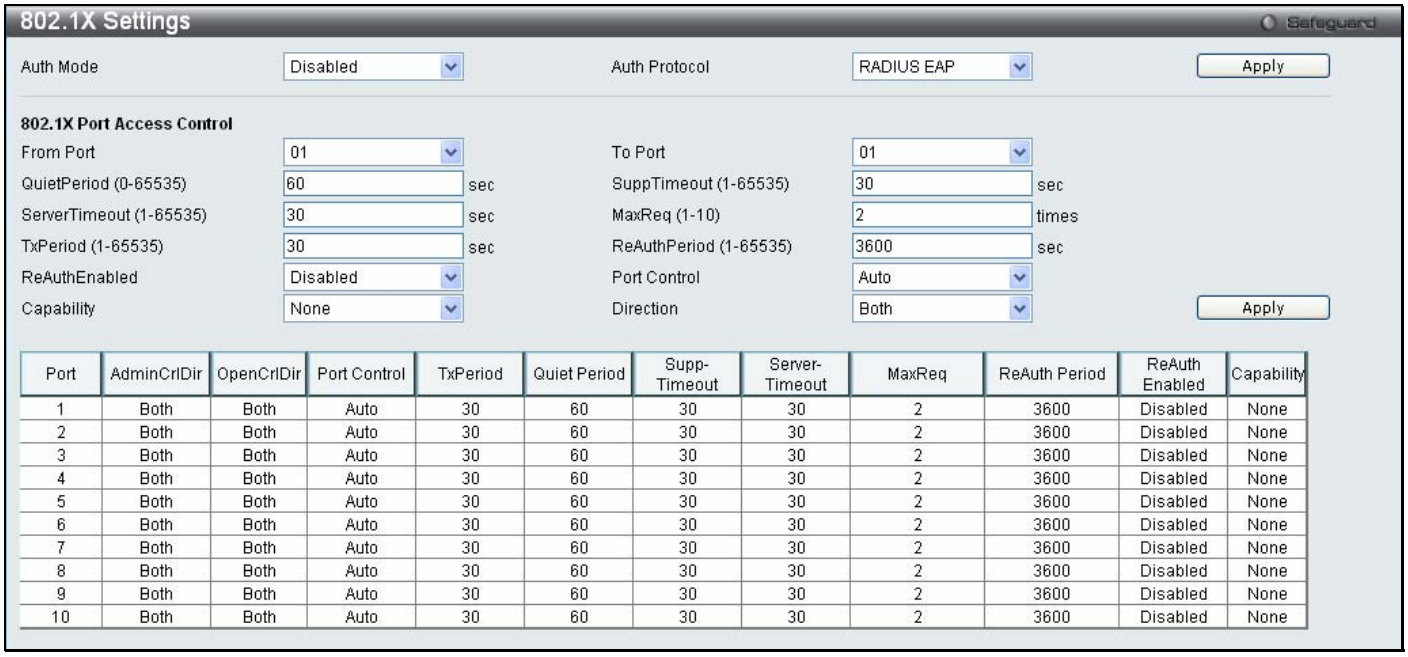
In order to successfully make use of 802.1X in a shared media LAN segment, it would be necessary to create "logical" Ports, one for each attached device that required access to the LAN. The Switch would regard the single physical Port connecting it to the shared media segment as consisting of a number of distinct logical Ports, each logical Port being independently controlled from the point of view of EAPOL exchanges and authorization state. The Switch learns each attached devices' individual MAC addresses, and effectively creates a logical Port that the attached device can then use to communicate with the LAN via the Switch.

The **802.1X** folder contains seven windows (depending on the current 802.1X) settings: **802.1X Settings**, **802.1X User**, **Initialize Port(s)** (Port-based and MAC-based), **Reauthenticate Port(s)** (Port-based and MAC-based), and **Authentic RADIUS Server**.

802.1X Settings

Users can configure 802.1X authenticator settings.

To view the following window, click **Security > 802.1X** > **802.1X Settings**:



Port	AdminCrlDir	OpenCrlDir	Port Control	TxPeriod	Quiet Period	Supp-Timeout	Server-Timeout	MaxReq	ReAuth Period	ReAuth Enabled	Capability
1	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
2	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
3	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
4	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
5	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
6	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
7	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
8	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
9	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None
10	Both	Both	Auto	30	60	30	30	2	3600	Disabled	None

Figure 5 - 23. 802.1X Settings window

Use the From Port and To Port drop-down menus to configure the settings by port(s):

This window allows setting of the following features:

Parameter	Description
Auth Mode	Choose the 802.1X authenticator mode, *Disabled*, *Port Based*, or *MAC Based*.
Auth Protocol	Choose the authenticator protocol, *Local* or *RADIUS EAP*.
From Port	Enter the beginning port of the range of ports to be set.
To Port	Enter the ending port of the range of ports to be set.
QuietPeriod (0-65535)	This allows the user to set the number of seconds that the Switch remains in the quiet state following a failed authentication exchange with the client. The default setting is *60* seconds.
SuppTimeout (1-65535)	This value determines timeout conditions in the exchanges between the Authenticator and the client. The default setting is *30* seconds.
ServerTimeout (1-65535)	This value determines timeout conditions in the exchanges between the Authenticator and the authentication server. The default setting is *30* seconds.
MaxReq (1-10)	The maximum number of times that the Switch will retransmit an EAP Request to the client before it times out of the authentication sessions. The default setting is *2*.
TxPeriod (1-65535)	This sets the TxPeriod of time for the authenticator PAE state machine. This value determines the period of an EAP Request/Identity packet transmitted to the client. The default setting is *30* seconds.
ReAuthPeriod (1-65535)	A constant that defines a nonzero number of seconds between periodic reauthentication of the client. The default setting is *3600* seconds.
ReAuthEnabled	Determines whether regular reauthentication will take place on this port. The default setting is *Disabled*.
Port Control	This allows the user to control the port authorization state. Select *ForceAuthorized* to disable 802.1X and cause the port to transition to the authorized state without any authentication exchange required. This means the port transmits and receives normal traffic without 802.1X-based authentication of the client. If *ForceUnauthorized* is selected, the port will remain in the unauthorized state, ignoring all

	attempts by the client to authenticate. The Switch cannot provide authentication services to the client through the interface. If *Auto* is selected, it will enable 802.1X and cause the port to begin in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. The authentication process begins when the link state of the port transitions from down to up, or when an EAPOL-start frame is received. The Switch then requests the identity of the client and begins relaying authentication messages between the client and the authentication server. The default setting is *Auto*.
Capability	This allows the 802.1X Authenticator settings to be applied on a per-port basis. Select *Authenticator* to apply the settings to the port. When the setting is activated, a user must pass the authentication process to gain access to the network. Select *None* disable 802.1X functions on the port.
Direction	Sets the administrative-controlled direction to *Both*. If *Both* is selected, control is exerted over both incoming and outgoing traffic through the controlled port selected in the first field. The *In* option is not supported in the present firmware release.

Click **Apply** to implement your configuration changes.

802.1X User

Users can set different local users on the Switch.

To view the following window, click **Security** > **802.1X** > **802.1X User**:

Figure 5 - 24. 802.1X User window

Enter an 802.1X user name, Password, and confirmation of that password. Properly configured local users will be displayed in the 802.1X User Table at the bottom of the window. Click **Apply** to implement your configuration changes.

Initialize Port(s)

Existing 802.1X port and host settings are displayed and can be configured using the two windows below.

To initialize ports for the port side of 802.1X, the user must first enable 802.1X by port in the **802.1X Settings** window.

To view the following window, click **Security > 802.1X > Initialize Port(s)**:

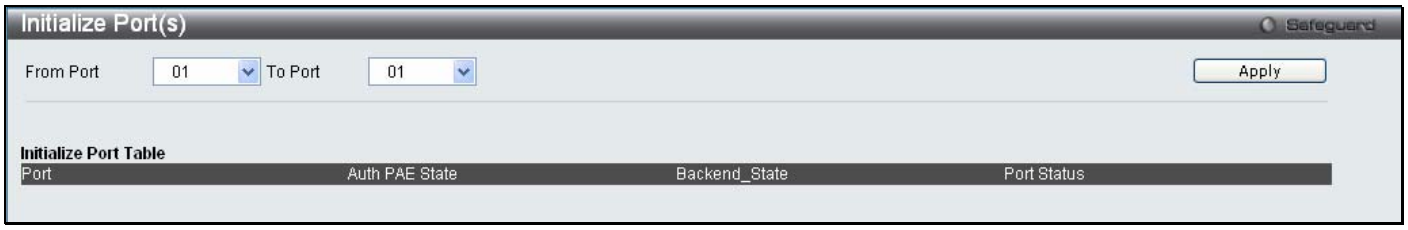


Figure 5 - 25. Initialize Port(s) window for Port-based 802.1X

This window allows initialization of a port or group of ports. The Initialize Port Table in the bottom half of the window displays the current status of the port(s). To initialize ports, choose the range of ports in the From Port and To Port fields. To begin the initialization, click **Apply**.

To initialize ports for the host side of 802.1X, the user must first enable 802.1X by MAC address in the **802.1X Settings** window.

To view the following window, click **Security > 802.1X > Initialize Port(s)**:

Figure 5 - 26. Initialize Port(s) window for Host-based 802.1X

To initialize ports, choose the range of ports in the From Port and To Port fields. Next, the user must specify the MAC address to be initialized by entering it into the MAC Address field and ticking the corresponding check box. To begin the initialization, click **Apply**.

NOTE: The user must first globally enable 802.1X in the **802.1X Settings** window (**Security** > **802.1X** > **802.1X Settings**) before initializing ports. Information in the **Initialize Port(s)** windows cannot be viewed before enabling 802.1X for either Port-based 802.1X or Host-based 802.1X.

The **Initalize Port(s)** windows displays the following information:

Parameter	Description
From Port	The beginning port in a range of ports to be initialized.
To Port	The ending port in a range of ports to be initialized.
Port	A read-only field indicating a port on the Switch.
Auth PAE State	The Authenticator PAE State will display one of the following: *Initialize, Disconnected, Connecting, Authenticating, Authenticated, Aborting, Held, ForceAuth, ForceUnauth,* and *N/A.*
Backend_State	The Backend Authentication State will display one of the following: *Request, Response, Success, Fail, Timeout, Idle, Initialize,* and *N/A.*
Port Status	The status of the controlled port can be *Authorized, Unauthorized,* or *N/A.*
MAC Address	The authenticated MAC address of the client connected to the corresponding port, if any.

Reauthenticate Port(s)

Users can display and configure reauthenticate ports for 802.1X port and host using the two windows below.

To reauthenticate ports for the port side of 802.1X, the user must first enable 802.1X by port in the **802.1X Settings** window

To view the following window, click **Security > 802.1X > Reauthenticate Port(s)**:

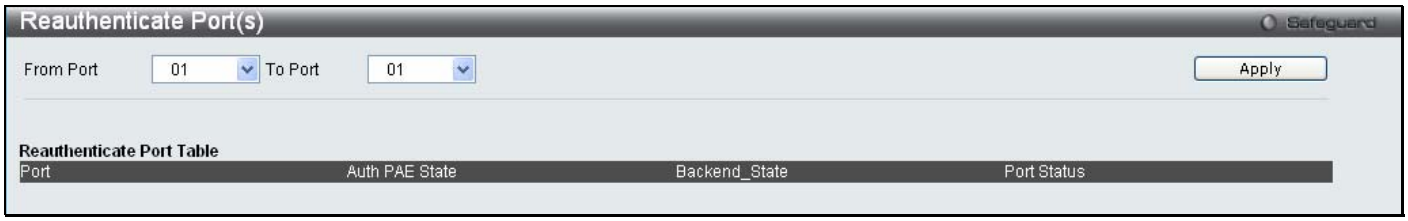


Figure 5 - 27. Reauthenticate Port(s) window for Port-based 802.1X

This window allows reauthentication of a port or group of ports by using the pull-down menus From Port and To Port and clicking **Apply**. The Reauthenticate Port Table displays the current status of the reauthenticated port(s) once **Apply** has been clicked**.**

NOTE: The user must first globally enable 802.1X in the **802.1X Settings** window (**Security** > **802.1X** > **802.1X Settings**) before reauthenticating ports. Information in the **Reauthenticate Port(s)** window cannot be viewed before enabling 802.1X.

To reauthenticate ports for the host side of 802.1X, the user must first enable 802.1X by MAC address in the **802.1X Settings** window.

To view the following window, click **Security > 802.1X > Reauthenticate Port(s)**:

Figure 5 - 28. Reauthenticate Port(s) window for Host-based 802.1X

To reauthenticate ports, first use the From Port and To Port drop-down menus to choose the range of ports. Then the user must specify the MAC address to be reauthenticated by entering it into the MAC Address field and ticking the corresponding check box. To begin the reauthentication, click **Apply**.

This window displays the following information:

Parameter	Description
From Port	The beginning port in a range of ports to be reauthenticated.
To Port	The ending port in a range of ports to be reauthenticated.
MAC Address	Displays the physical address of the Switch where the port resides.
Auth PAE State	The Authenticator State will display one of the following: *Initialize, Disconnected, Connecting, Authenticating, Authenticated, Aborting, Held, ForceAuth, ForceUnauth,* and *N/A.*
Backend_State	The Backend State will display one of the following: *Request, Response, Success, Fail, Timeout, Idle, Initialize,* and *N/A.*
Port Status	The status of the controlled port can be *Authorized, Unauthorized,* or *N/A*.

Authentic RADIUS Server

The RADIUS feature of the Switch allows the user to facilitate centralized user administration as well as providing protection against a sniffing, active hacker. The Web manager offers three windows.

To view the following window, click **Security > 802.1X > Authentic RADIUS Server**:

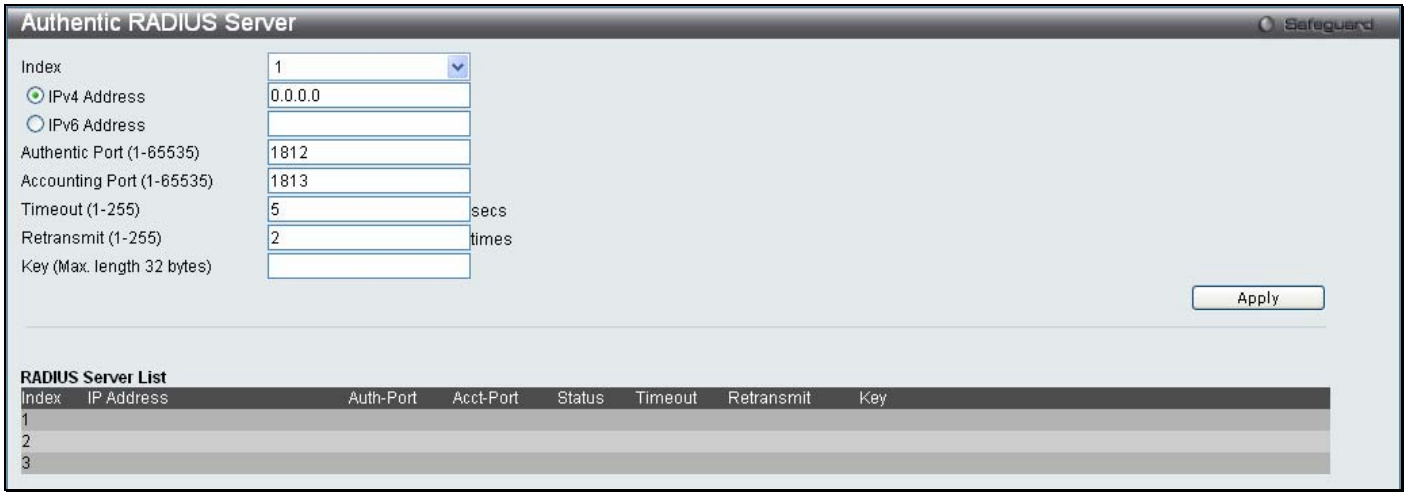


Figure 5 - 29. Authentic RADIUS Server window

This window displays the following information:

Parameter	Description
Index	Choose the desired RADIUS server to configure: *1, 2* or *3* and select either IPv4 Address or IPv6 Address.
IP Address	Set the RADIUS server IP address.
Authentic Port (1-65535)	Set the RADIUS authentic server(s) UDP port which is used to transmit RADIUS data between the Switch and the RADIUS server. The default port is *1812*.
Accounting Port (1-65535)	Set the RADIUS account server(s) UDP port which is used to transmit RADIUS accounting statistics between the Switch and the RADIUS server. The default port is *1813*.
Timeout (1-255)	Set the RADIUS server age-out, in seconds.
Retransmit (1-255)	Set the RADIUS server retransmit time, in seconds.
Key (Max. length 32 bytes)	Set the key the same as that of the RADIUS server.

SSL Settings

Secure Sockets Layer, or SSL, is a security feature that will provide a secure communication path between a host and client through the use of authentication, digital signatures and encryption. These security functions are implemented through the use of a ciphersuite, which is a security string that determines the exact cryptographic parameters, specific encryption algorithms and key sizes to be used for an authentication session and consists of three levels:

1. **Key Exchange:** The first part of the cyphersuite string specifies the public key algorithm to be used. This switch utilizes the Rivest Shamir Adleman (RSA) public key algorithm and the Digital Signature Algorithm (DSA), specified here as the *DHE DSS* Diffie-Hellman (DHE) public key algorithm. This is the first authentication process between client and host as they "exchange keys" in looking for a match and therefore authentication to be accepted to negotiate encryptions on the following level.
2. **Encryption:** The second part of the ciphersuite that includes the encryption used for encrypting the messages sent between client and host. The Switch supports two types of cryptology algorithms:

Stream Ciphers – There are two types of stream ciphers on the Switch, *RC4 with 40-bit keys* and *RC4 with 128-bit keys*. These keys are used to encrypt messages and need to be consistent between client and host for optimal use.

CBC Block Ciphers – CBC refers to Cipher Block Chaining, which means that a portion of the previously encrypted block of encrypted text is used in the encryption of the current block. The Switch supports the *3DES EDE* encryption code defined by the Data Encryption Standard (DES) to create the encrypted text.

3. **Hash Algorithm**: This part of the ciphersuite allows the user to choose a message digest function which will determine a Message Authentication Code. This Message Authentication Code will be encrypted with a sent message to provide integrity and prevent against replay attacks. The Switch supports two hash algorithms, *MD5* (Message Digest 5) and *SHA* (Secure Hash Algorithm).

These three parameters are uniquely assembled in four choices on the Switch to create a three-layered encryption code for secure communication between the server and the host. The user may implement any one or combination of the ciphersuites available, yet different ciphersuites will affect the security level and the performance of the secured connection. The information included in the ciphersuites is not included with the Switch and requires downloading from a third source in a file form called a *certificate*. This function of the Switch cannot be executed without the presence and implementation of the certificate file and can be downloaded to the Switch by utilizing a TFTP server. The Switch supports SSLv3. Other versions of SSL may not be compatible with this Switch and may cause problems upon authentication and transfer of messages from client to host.

The **SSL Settings** window located on the next page will allow the user to enable SSL on the Switch and implement any one or combination of listed ciphersuites on the Switch. A ciphersuite is a security string that determines the exact cryptographic parameters, specific encryption algorithms and key sizes to be used for an authentication session. The Switch possesses four possible ciphersuites for the SSL function, which are all enabled by default. To utilize a particular ciphersuite, disable the unwanted ciphersuites, leaving the desired one for authentication.

When the SSL function has been enabled, the web will become disabled. To manage the Switch through the web based management while utilizing the SSL function, the web browser must support SSL encryption and the header of the URL must begin with https://. (Ex. https://xx.xx.xx.xx) Any other method will result in an error and no access can be authorized for the web-based management.

Users can download a certificate file for the SSL function on the Switch from a TFTP server. The certificate file is a data record used for authenticating devices on the network. It contains information on the owner, keys for authentication and digital signatures. Both the server and the client must have consistent certificate files for optimal use of the SSL function. The Switch only supports certificate files with .der file extensions. Currently, the Switch comes with a certificate pre-loaded though the user may need to download more, depending on user circumstances.

To view the following window, click **Security > SSL Settings**:

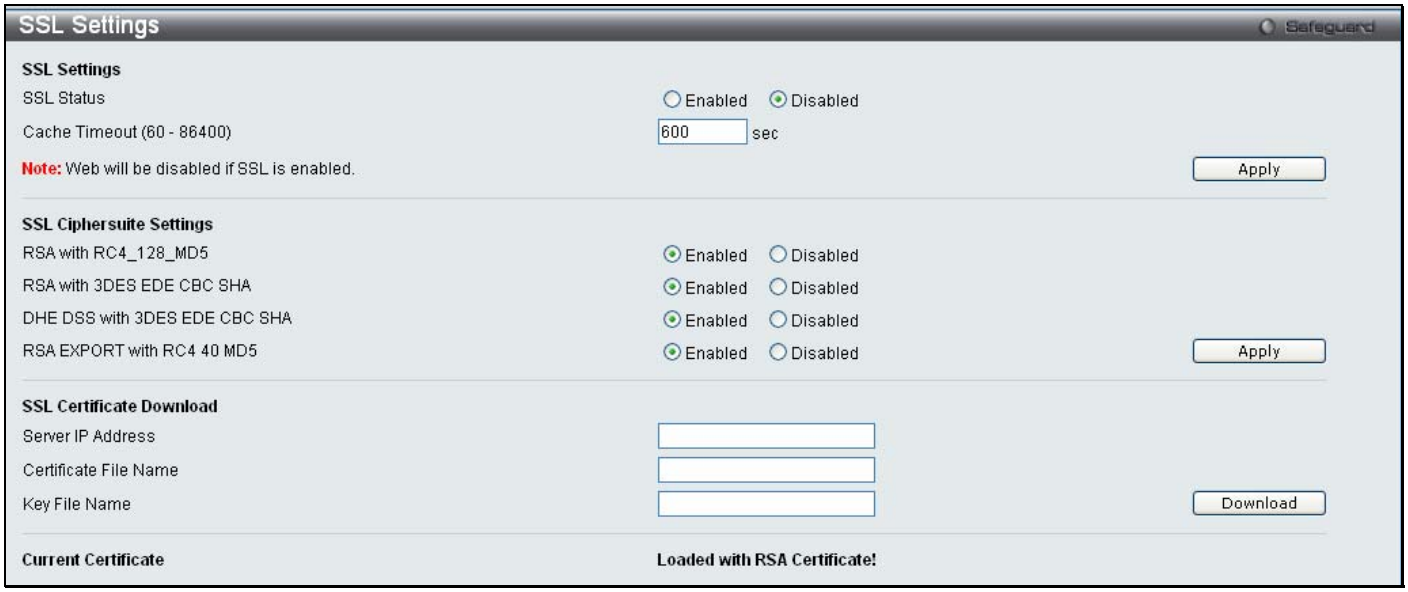


Figure 5 - 30. SSL Settings window

To set up the SSL function on the Switch, configure the parameters in the SSL Settings section described below and click **Apply**.

To set up the SSL ciphersuite function on the Switch, configure the parameters in the SSL Ciphersuite Settings section described below and click **Apply**.

To download SSL certificates, configure the parameters in the SSL Certificate Download section described below and click **Download**.

Parameter	Description
SSL Settings	
SSL Status	Use the radio buttons to enable or disable the SSL status on the Switch. The default is Disabled.
Cache Timeout (60-86400)	This field will set the time between a new key exchange between a client and a host using the SSL function. A new SSL session is established every time the client and host go through a key exchange. Specifying a longer timeout will allow the SSL session to reuse the master key on future connections with that particular host, therefore speeding up the negotiation process. The default setting is *600* seconds.
SSL Ciphersuite Settings	
RSA with RC4_128_MD5	This ciphersuite combines the RSA key exchange, stream cipher RC4 encryption with 128-bit keys and the MD5 Hash Algorithm. Use the radio buttons to enable or disable this ciphersuite. This field is Enabled by default.
RSA with 3DES EDE CBC SHA	This ciphersuite combines the RSA key exchange, CBC Block Cipher 3DES_EDE encryption and the SHA Hash Algorithm. Use the radio buttons to enable or disable this ciphersuite. This field is Enabled by default.
DHS DSS with 3DES EDE CBC SHA	This ciphersuite combines the DSA Diffie Hellman key exchange, CBC Block Cipher 3DES_EDE encryption and SHA Hash Algorithm. Use the radio buttons to enable or disable this ciphersuite. This field is Enabled by default.
RSA EXPORT with RC4 40 MD5	This ciphersuite combines the RSA Export key exchange and stream cipher RC4 encryption with 40-bit keys. Use the radio buttons to enable or disable this ciphersuite. This field is Enabled by default.
SSL Certificate Download	
Server IP Address	Enter the IPv4 address of the TFTP server where the certificate files are located.
Certificate File Name	Enter the path and the filename of the certificate file to download. This file must have a .der extension. (Ex. c:/cert.der)

Key File Name	Enter the path and the filename of the key file to download. This file must have a .der extension (Ex. c:/pkey.der)

Click **Apply** to implement changes made.

NOTE: Certain implementations concerning the function and configuration of SSL are not available on the web-based management of this Switch and need to be configured using the command line interface.

NOTE: Enabling the SSL command will disable the web-based switch management. To log on to the Switch again, the header of the URL must begin with https://. Entering anything else into the address field of the web browser will result in an error and no authentication will be granted.

SSH

SSH is an abbreviation of Secure Shell, which is a program allowing secure remote login and secure network services over an insecure network. It allows a secure login to remote host computers, a safe method of executing commands on a remote end node, and will provide secure encrypted and authenticated communication between two non-trusted hosts. SSH, with its array of unmatched security features is an essential tool in today's networking environment. It is a powerful guardian against numerous existing security hazards that now threaten network communications.

The steps required to use the SSH protocol for secure communication between a remote PC (the SSH client) and the Switch (the SSH server) are as follows:

1. Create a user account with admin-level access using the **User Accounts** window (**Configuration** > **Port Configuration** > **User Accounts**). This is identical to creating any other admin-level User Account on the Switch, including specifying a password. This password is used to logon to the Switch, once a secure communication path has been established using the SSH protocol.
2. Configure the User Account to use a specified authorization method to identify users that are allowed to establish SSH connections with the Switch using the **SSH User Authentication Mode** window. There are three choices as to the method SSH will use to authorize the user, which are Host Based, Password, and Public Key.
3. Configure the encryption algorithm that SSH will use to encrypt and decrypt messages sent between the SSH client and the SSH server, using the **SSH Authmode and Algorithm Settings** window.
4. Finally, enable SSH on the Switch using the **SSH Configuration** window.

After completing the preceding steps, a SSH Client on a remote PC can be configured to manage the Switch using a secure, in band connection.

SSH Configuration

Users can configure and view settings for the SSH server.

To view the following window, click **Security > SSH > SSH Configuration**:

Figure 5 - 31. SSH Configuration window

To configure the SSH server on the Switch, modify the following parameters and click **Apply**:

Parameter	Description
SSH Server Status	Use the radio buttons to enable or disable SSH on the Switch. The default is Disabled.
Max Session (1-8)	Enter a value between *1* and *8* to set the number of users that may simultaneously access the Switch. The default setting is *8*.
Connection Timeout (120-600 sec)	Allows the user to set the connection timeout. The user may set a time between *120* and *600* seconds. The default setting is *120* seconds.
Max. Auth. Fail Time (2-20)	Allows the Administrator to set the maximum number of attempts that a user may try to log on to the SSH Server utilizing the SSH authentication. After the maximum number of attempts has been exceeded, the Switch will be disconnected and the user must reconnect to the Switch to attempt another login. The number of maximum attempts may be set between *2* and *20*. The default setting is *2*.
Session Rekeying	This field is used to set the time period that the Switch will change the security shell encryptions by using the pull-down menu. The available options are *Never*, *10 min*, *30 min*, and *60 min*. The default setting is *Never*.

SSH Authmode and Algorithm Settings

Users can configure the desired types of SSH algorithms used for authentication encryption. There are three categories of algorithms listed and specific algorithms of each may be enabled or disabled by ticking their corresponding check boxes. All algorithms are enabled by default.

To view the following window, click **Security > SSH > SSH Authmode and Algorithm Settings**:

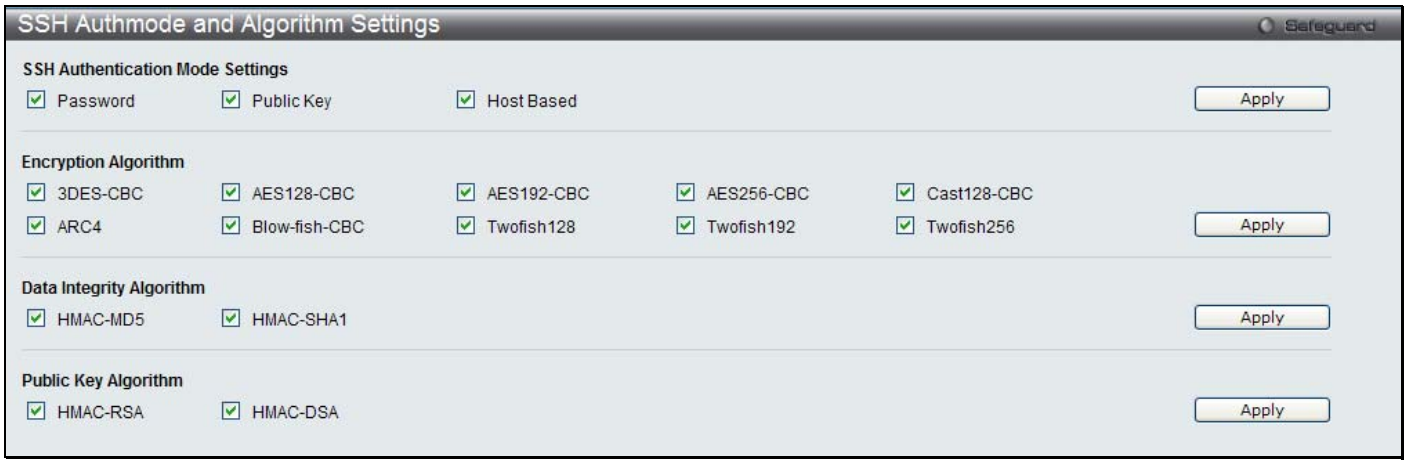


Figure 5 - 32. SSH Authmode and Algorithm Settings window

The following algorithms may be set:

Parameter	Description
SSH Authentication Mode Settings	
Password	This may be enabled or disabled to choose if the administrator wishes to use a locally configured password for authentication on the Switch. This parameter is enabled by default.
Public Key	This may be enabled or disabled to choose if the administrator wishes to use a public key configuration set on a SSH server, for authentication. This parameter is enabled by default.
Host Based	This may be enabled or disabled to choose if the administrator wishes to use a host computer for authentication. This parameter is intended for Linux users requiring SSH authentication techniques and the host computer is running the Linux operating system with a SSH program previously installed. This parameter is enabled by default.
Encryption Algorithm	
3DES-CBC	Use the check box to enable or disable the Triple Data Encryption Standard encryption algorithm with Cipher Block Chaining. The default is enabled.
Blow-fish CBC	Use the check box to enable or disable the Blowfish encryption algorithm with Cipher Block Chaining. The default is enabled.
AES128-CBC	Use the check box to enable or disable the Advanced Encryption Standard AES128 encryption algorithm with Cipher Block Chaining. The default is enabled.
AES192-CBC	Use the check box to enable or disable the Advanced Encryption Standard AES192 encryption algorithm with Cipher Block Chaining. The default is enabled.
AES256-CBC	Use the check box to enable or disable the Advanced Encryption Standard AES-256 encryption algorithm with Cipher Block Chaining. The default is enabled.
ARC4	Use the check box to enable or disable the Arcfour encryption algorithm with Cipher Block Chaining. The default is enabled.
Cast128-CBC	Use the check box to enable or disable the Cast128 encryption algorithm with Cipher Block Chaining. The default is enabled.
Twofish128	Use the check box to enable or disable the twofish128 encryption algorithm. The default is enabled.
Twofish192	Use the check box to enable or disable the twofish192 encryption algorithm. The default is enabled.
Twofish256	Use the check box to enable or disable the twofish256 encryption algorithm. The default is enabled.
Data Integrity Algorithm	
HMAC-SHA1	Use the check box to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the Secure Hash algorithm. The default is enabled.
HMAC-MD5	Use the check box to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the MD5 Message Digest encryption algorithm. The default is enabled.
Public Key Algorithm	
HMAC-RSA	Use the check box to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the RSA encryption algorithm. The default is enabled.
HMAC-DSA	Use the check box to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the Digital Signature Algorithm (DSA) encryption. The default is enabled.

Click **Apply** to implement changes made.

SSH User Authentication Mode

Users can configure parameters for users attempting to access the Switch through SSH.

To view the following window, click **Security > SSH > SSH User Authentication Mode**:

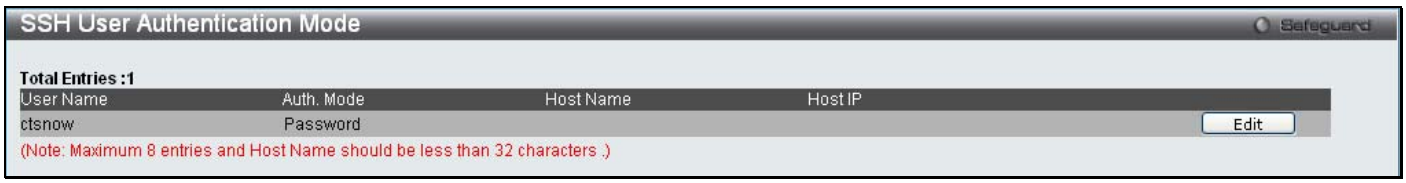


Figure 5 - 33. SSH User Authentication Mode window

In the window above, the User Account "ctsnow" has been previously set using the **User Accounts** window in the **Configuration** folder. A User Account MUST be set in order to set the parameters for the SSH user. To configure the parameters for a SSH user, click the **Edit** button corresponding to the table entry on this window.

The user may view or set the following parameters:

Parameter	Description
User Name	A name of no more than 15 characters to identify the SSH user. This User Name must be a previously configured user account on the Switch.
Auth. Mode	The administrator may choose one of the following to set the authorization for users attempting to access the Switch. *Host Based* – This parameter should be chosen if the administrator wishes to use a remote SSH server for authentication purposes. Choosing this parameter requires the user to input the following information to identify the SSH user. • *Host Name* – Enter an alphanumeric string of no more than 32 characters to identify the remote SSH user. • *Host IP* – Enter the corresponding IP address of the SSH user. *Password* – This parameter should be chosen if the administrator wishes to use an administrator-defined password for authentication. Upon entry of this parameter, the Switch will prompt the administrator for a password, and then to re-type the password for confirmation. *Public Key* – This parameter should be chosen if the administrator wishes to use the publickey on a SSH server for authentication.
Host Name	Enter an alphanumeric string of no more than 32 characters to identify the remote SSH user. This parameter is only used in conjunction with the *Host Based* choice in the Auth. Mode field.
Host IP	Enter the corresponding IP address of the SSH user. This parameter is only used in conjunction with the *Host Based* choice in the Auth. Mode field.

Click **Apply** to implement changes made.

NOTE: To set the SSH User Authentication Mode parameters on the Switch, a User Account must be previously configured.

Access Authentication Control

The TACACS / XTACACS / TACACS+ / RADIUS commands allow users to secure access to the Switch using the TACACS / XTACACS / TACACS+ / RADIUS protocols. When a user logs in to the Switch or tries to access the administrator level privilege, he or she is prompted for a password. If TACACS / XTACACS / TACACS+ / RADIUS authentication is enabled on the Switch, it will contact a TACACS / XTACACS / TACACS+ / RADIUS server to verify the user. If the user is verified, he or she is granted access to the Switch.

There are currently three versions of the TACACS security protocol, each a separate entity. The Switch's software supports the following versions of TACACS:

- **TACACS** (Terminal Access Controller Access Control System) - Provides password checking and authentication, and notification of user actions for security purposes utilizing via one or more centralized TACACS servers, utilizing the UDP protocol for packet transmission.
- **Extended TACACS (XTACACS)** - An extension of the TACACS protocol with the ability to provide more types of authentication requests and more types of response codes than TACACS. This protocol also uses UDP to transmit packets.
- **TACACS+ (Terminal Access Controller Access Control System plus**) - Provides detailed access control for authentication for network devices. TACACS+ is facilitated through Authentication commands via one or more centralized servers. The TACACS+ protocol encrypts all traffic between the Switch and the TACACS+ daemon, using the TCP protocol to ensure reliable delivery

In order for the TACACS / XTACACS / TACACS+ / RADIUS security function to work properly, a TACACS / XTACACS / TACACS+ / RADIUS server must be configured on a device other than the Switch, called an Authentication Server Host and it must include usernames and passwords for authentication. When the user is prompted by the Switch to enter usernames and passwords for authentication, the Switch contacts the TACACS / XTACACS / TACACS+ / RADIUS server to verify, and the server will respond with one of three messages:

The server verifies the username and password, and the user is granted normal user privileges on the Switch.

The server will not accept the username and password and the user is denied access to the Switch.

The server doesn't respond to the verification query. At this point, the Switch receives the timeout from the server and then moves to the next method of verification configured in the method list.

The Switch has four built-in Authentication Server Groups, one for each of the TACACS, XTACACS, TACACS+ and RADIUS protocols. These built-in Authentication Server Groups are used to authenticate users trying to access the Switch. The users will set Authentication Server Hosts in a preferable order in the built-in Authentication Server Groups and when a user tries to gain access to the Switch, the Switch will ask the first Authentication Server Hosts for authentication. If no authentication is made, the second server host in the list will be queried, and so on. The built-in Authentication Server Groups can only have hosts that are running the specified protocol. For example, the TACACS Authentication Server Groups can only have TACACS Authentication Server Hosts.

The administrator for the Switch may set up six different authentication techniques per user-defined method list (TACACS / XTACACS / TACACS+ / RADIUS / local / none) for authentication. These techniques will be listed in an order preferable, and defined by the user for normal user authentication on the Switch, and may contain up to eight authentication techniques. When a user attempts to access the Switch, the Switch will select the first technique listed for authentication. If the first technique goes through its Authentication Server Hosts and no authentication is returned, the Switch will then go to the next technique listed in the server group for authentication, until the authentication has been verified or denied, or the list is exhausted.

Please note that users granted access to the Switch will be granted normal user privileges on the Switch. To gain access to administrator level privileges, the user must access the **Enable Admin** window and then enter a password, which was previously configured by the administrator of the Switch.

NOTE: TACACS, XTACACS and TACACS+ are separate entities and are not compatible. The Switch and the server must be configured exactly the same, using the same protocol. (For example, if the Switch is set up for TACACS authentication, so must be the host server.)

Authentication Policy and Parameter Settings

Users can enable an administrator-defined authentication policy for users trying to access the Switch. When enabled, the device will check the Login Method List and choose a technique for user authentication upon login.

To view the following window, click **Security > Access Authentication Control > Authentication Policy and Parameter Settings**:

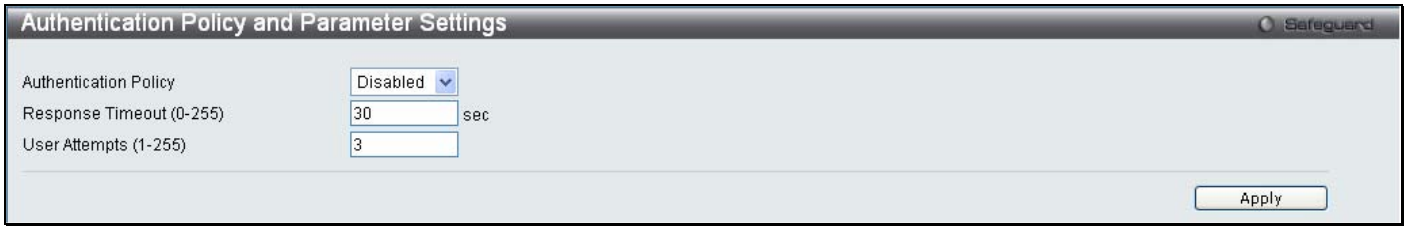


Figure 5 - 34. Authentication Policy and Parameter Settings window

The following parameters can be set:

Parameter	Description
Authentication Policy	Use the pull-down menu to enable or disable the Authentication Policy on the Switch.
Response Timeout (0-255)	This field will set the time the Switch will wait for a response of authentication from the user. The user may set a time between *0* and *255* seconds. The default setting is *30* seconds.
User Attempts (1-255)	This command will configure the maximum number of times the Switch will accept authentication attempts. Users failing to be authenticated after the set amount of attempts will be denied access to the Switch and will be locked out of further authentication attempts. Command line interface users will have to wait 60 seconds before another authentication attempt. Telnet and web users will be disconnected from the Switch. The user may set the number of attempts from *1* to *255*. The default setting is *3*.

Click **Apply** to implement changes made.

Application Authentication Settings

Users can configure Switch configuration applications (console, Telnet, SSH, web) for login at the user level and at the administration level (Enable Admin**)** utilizing a previously configured method list.

To view the following window, click **Security > Access Authentication Control > Application Authentication Settings**:

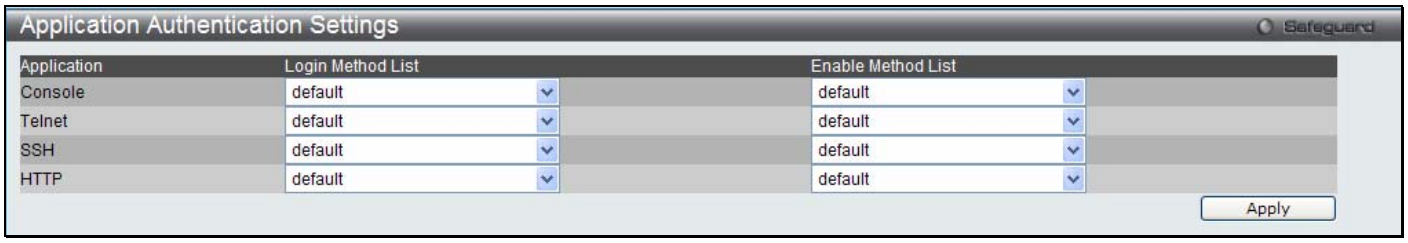


Figure 5 - 35. Application Authentication Settings window

The following parameters can be set:

Parameter	Description
Application	Lists the configuration applications on the Switch. The user may configure the Login Method List and Enable Method List for authentication for users utilizing the Console (Command Line Interface) application, the Telnet application, SSH, and the Web (HTTP) application.
Login Method List	Using the pull-down menu, configure an application for normal login on the user level, utilizing a previously configured method list. The user may use the default Method List or other Method List configured by the user. See the **Login Method Lists** window, in this

	section, for more information.
Enable Method List	Using the pull-down menu, configure an application for normal login on the user level, utilizing a previously configured method list. The user may use the default Method List or other Method List configured by the user. See the **Enable Method Lists** window, in this section, for more information

Click **Apply** to implement changes made.

Authentication Server Group

Users can set up Authentication Server Groups on the Switch. A server group is a technique used to group TACACS/XTACACS/TACACS+/RADIUS server hosts into user-defined categories for authentication using method lists. The user may define the type of server group by protocol or by previously defined server group. The Switch has three built-in Authentication Server Groups that cannot be removed but can be modified. Up to eight authentication server hosts may be added to any particular group.

To view the following window, click **Security > Access Authentication Control > Authentication Server Group**:

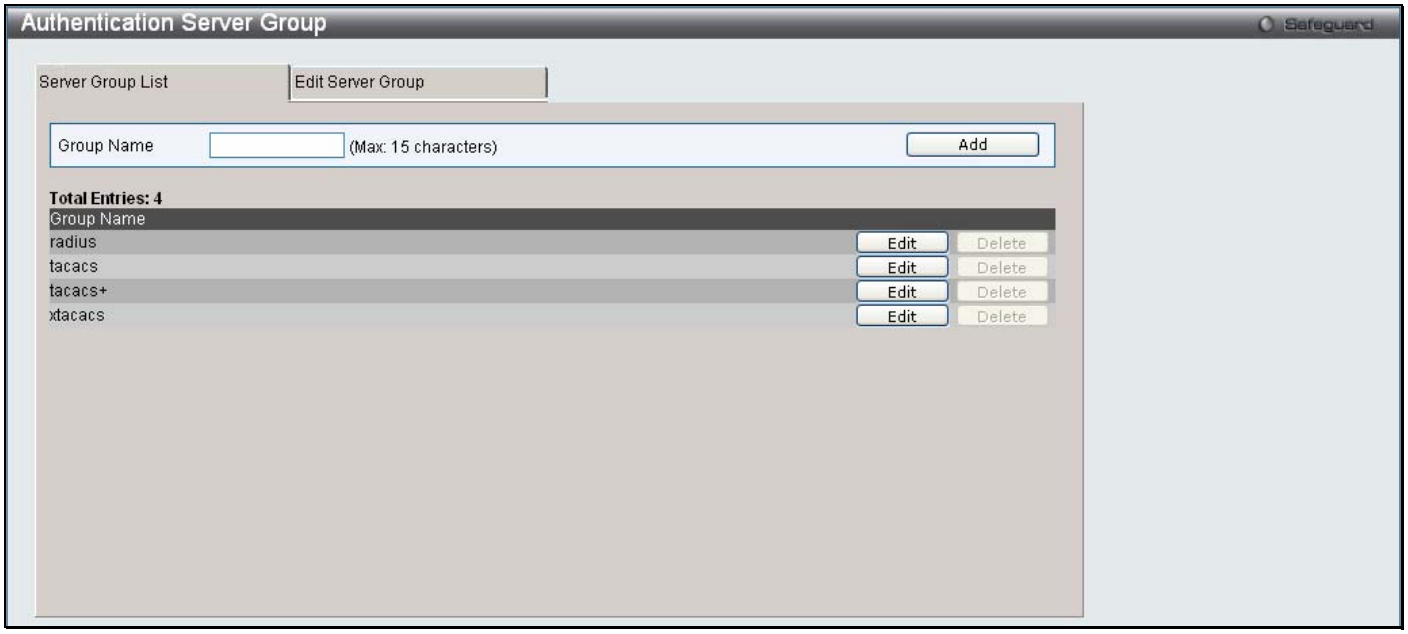


Figure 5 - 36. Server Group List tab of the Authentication Server Group window

This window displays the Authentication Server Groups on the Switch. The Switch has four built-in Authentication Server Groups that cannot be removed but can be modified. To add a new Server Group, enter a name in the Group Name field and then click the **Add** button. To modify a particular group, click the **Edit** button (or the **Edit Server Group** tab), which will then display the following **Edit Server Group** tab:

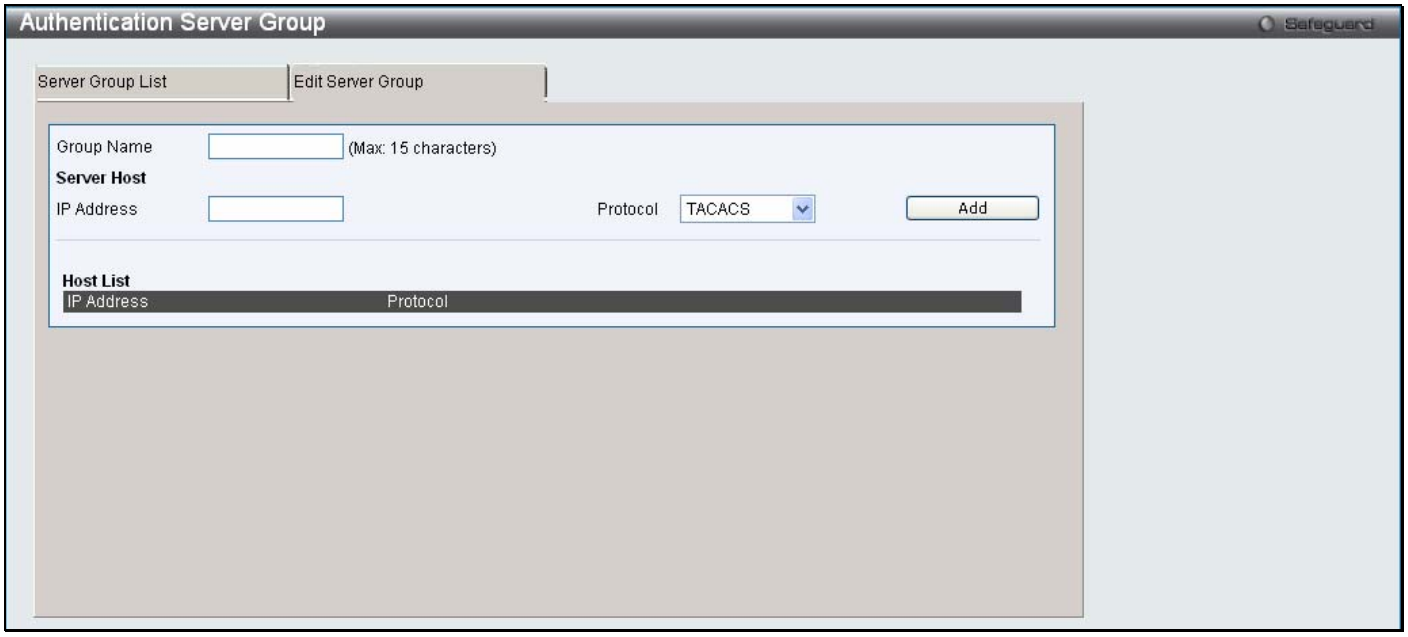


Figure 5 - 37. Edit Server Group tab of the Authentication Server Group window

To add an Authentication Server Host to the list, enter its name in the Group Name field, IP address in the IP Address field, use the drop-down menu to choose the Protocol associated with the IP address of the Authentication Server Host, and then click **Add** to add this Authentication Server Host to the group. The entry should appear in the Host List at the bottom of this tab.

To add a server group other than the ones listed, enter a name of up to 15 characters in the Group Name field, an IP address in the IP Address field, use the drop-down menu to choose the Protocol associated with the IP address, and then click **Apply**. The entry should appear in the **Server Group List** tab.

NOTE: The user must configure Authentication Server Hosts using the Authentication Server Hosts window before adding hosts to the list. Authentication Server Hosts must be configured for their specific protocol on a remote centralized server before this function can work properly.

NOTE: The three built-in server groups can only have server hosts running the same TACACS daemon. TACACS/XTACACS/TACACS+ protocols are separate entities and are not compatible with each other.

Authentication Server Host

User-defined Authentication Server Hosts for the TACACS / XTACACS / TACACS+ / RADIUS security protocols can be set on the Switch. When a user attempts to access the Switch with Authentication Policy enabled, the Switch will send authentication packets to a remote TACACS / XTACACS / TACACS+ / RADIUS server host on a remote host. The TACACS / XTACACS / TACACS+ / RADIUS server host will then verify or deny the request and return the appropriate message to the Switch. More than one authentication protocol can be run on the same physical server host but, remember that TACACS / XTACACS / TACACS+ / RADIUS are separate entities and are not compatible with each other. The maximum supported number of server hosts is 16.

To view the following window, click **Security > Access Authentication Control > Authentication Server Host**:

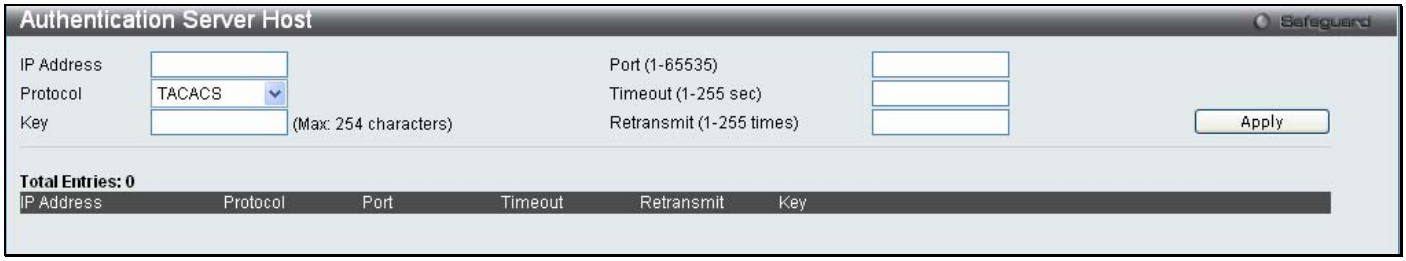


Figure 5 - 38. Authentication Server Host window

Configure the following parameters to add an Authentication Server Host:

Parameter	Description
IP Address	The IP address of the remote server host to add.
Protocol	The protocol used by the server host. The user may choose one of the following: *TACACS* - Enter this parameter if the server host utilizes the TACACS protocol. *XTACACS* - Enter this parameter if the server host utilizes the XTACACS protocol. *TACACS+* - Enter this parameter if the server host utilizes the TACACS+ protocol. *RADIUS* - Enter this parameter if the server host utilizes the RADIUS protocol.
Key	Authentication key to be shared with a configured TACACS+ or RADIUS servers only. Specify an alphanumeric string up to 254 characters.
Port (1-65535)	Enter a number between *1* and *65535* to define the virtual port number of the authentication protocol on a server host. The default port number is *49* for TACACS/XTACACS/TACACS+ servers and *1813* for RADIUS servers but the user may set a unique port number for higher security.
Timeout (1-255 secs)	Enter the time in seconds the Switch will wait for the server host to reply to an authentication request. The default value is *5* seconds.
Retransmit (1-255 times)	Enter the value in the retransmit field to change how many times the device will resend an authentication request when the TACACS server does not respond.

Click **Apply** to add the server host.

NOTE: More than one authentication protocol can be run on the same physical server host but, remember that TACACS/XTACACS/TACACS+ are separate entities and are not compatible with each other.

Login Method Lists

User-defined or default Login Method List of authentication techniques can be configured for users logging on to the Switch. The sequence of techniques implemented in this command will affect the authentication result. For example, if a user enters a sequence of techniques, for example TACACS - XTACACS- local, the Switch will send an authentication request to the first TACACS host in the server group. If no response comes from the server host, the Switch will send an authentication request to the second TACACS host in the server group and so on, until the list is exhausted. At that point, the Switch will restart the same sequence with the following protocol listed, XTACACS. If no authentication takes place using the XTACACS list, the local account database set in the Switch is used to authenticate the user. When the local method is used, the privilege level will be dependant on the local account privilege configured on the Switch.

Successful login using any of these techniques will give the user a "User" privilege only. If the user wishes to upgrade his or her status to the administrator level, the user must use the **Enable Admin** window, in which the user must enter a previously configured password, set by the administrator.

To view the following window, click **Security > Access Authentication Control > Login Method Lists**:

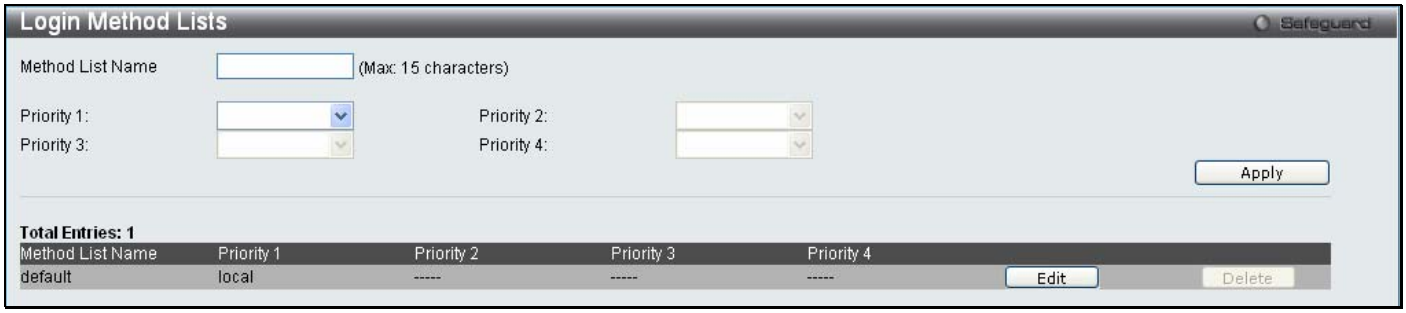


Figure 5 - 39. Login Method Lists window

The Switch contains one Method List that is set and cannot be removed, yet can be modified. To delete a Login Method List defined by the user, click the **Delete** button corresponding to the entry desired to be deleted. To modify a Login Method List, click on its corresponding **Edit** button..

To define a Login Method List, set the following parameters and click **Apply**:

Parameter	Description
Method List Name	Enter a method list name defined by the user of up to 15 characters.
Priority 1, 2, 3, 4	The user may add one, or a combination of up to four of the following authentication methods to this method list: *tacacs* - Adding this parameter will require the user to be authenticated using the TACACS protocol from a remote TACACS server. *xtacacs* - Adding this parameter will require the user to be authenticated using the XTACACS protocol from a remote XTACACS server. *tacacs+* - Adding this parameter will require the user to be authenticated using the TACACS+ protocol from a remote TACACS+ server. *radius* - Adding this parameter will require the user to be authenticated using the RADIUS protocol from a remote RADIUS server. *local* - Adding this parameter will require the user to be authenticated using the local user account database on the Switch. *none* - Adding this parameter will require no authentication to access the Switch.

Enable Method Lists

Users can set up Method Lists to promote users with user level privileges to Administrator (Admin) level privileges using authentication methods on the Switch. Once a user acquires normal user level privileges on the Switch, he or she must be authenticated by a method on the Switch to gain administrator privileges on the Switch, which is defined by the Administrator. A maximum of eight Enable Method Lists can be implemented on the Switch, one of which is a default Enable Method List. This default Enable Method List cannot be deleted but can be configured.

The sequence of methods implemented in this command will affect the authentication result. For example, if a user enters a sequence of methods like TACACS - XTACACS - Local Enable, the Switch will send an authentication request to the first TACACS host in the server group. If no verification is found, the Switch will send an authentication request to the second TACACS host in the server group and so on, until the list is exhausted. At that point, the Switch will restart the same sequence with the following protocol listed, XTACACS. If no authentication takes place using the XTACACS list, the Local Enable password set in the Switch is used to authenticate the user.

Successful authentication using any of these methods will give the user an "Admin" privilege.

NOTE: To set the Local Enable Password, see the next section, entitled Local Enable Password.

To view the following window, click **Security > Access Authentication Control > Enable Method Lists**:

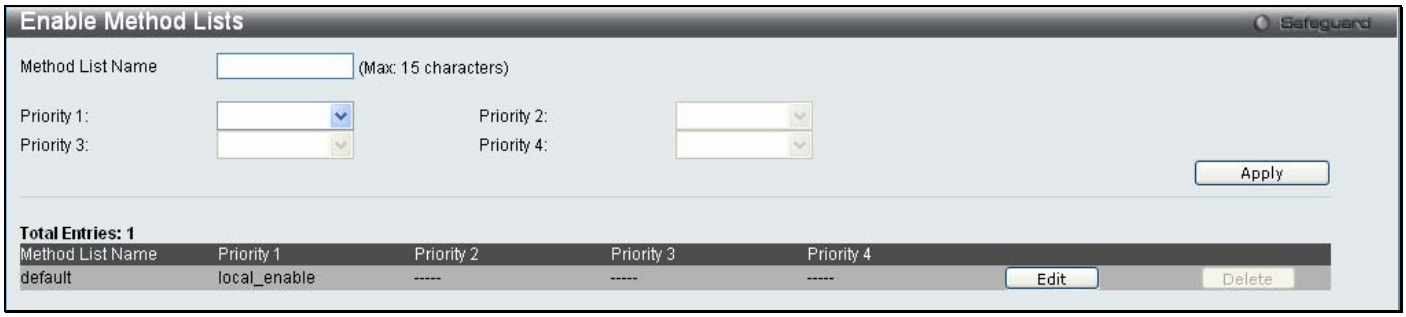


Figure 5 - 40. Enable Method Lists window

To delete an Enable Method List defined by the user, click the **Delete** button corresponding to the entry desired to be deleted. To modify an Enable Method List, click on its corresponding **Edit** button.

To define an Enable Login Method List, set the following parameters and click **Apply**:

Parameter	Description
Method List Name	Enter a method list name defined by the user of up to 15 characters.
Priority 1, 2, 3, 4	The user may add one, or a combination of up to four of the following authentication methods to this method list: *local_enable* - Adding this parameter will require the user to be authenticated using the local enable password database on the Switch. The local enable password must be set by the user in the next section entitled Local Enable Password. *none* - Adding this parameter will require no authentication to access the Switch. *radius* - Adding this parameter will require the user to be authenticated using the RADIUS protocol from a remote RADIUS server. *tacacs* - Adding this parameter will require the user to be authenticated using the TACACS protocol from a remote TACACS server. *xtacacs* - Adding this parameter will require the user to be authenticated using the XTACACS protocol from a remote XTACACS server. *tacacs+* - Adding this parameter will require the user to be authenticated using the TACACS protocol from a remote TACACS server.

Configure Local Enable Password

Users can configure the locally enabled password for Enable Admin. When a user chooses the "local_enable" method to promote user level privileges to administrator privileges, he or she will be prompted to enter the password configured here that is locally set on the Switch.

To view the following window, click **Security > Access Authentication Control > Configure Local Enable Password**:

Figure 5 - 41. Configure Local Enable Password window

To set the Local Enable Password, set the following parameters and click **Apply**.

Parameter	Description
Old Local Enable Password	If a password was previously configured for this entry, enter it here in order to change it to a new password
New Local Enable Password	Enter the new password that you wish to set on the Switch to authenticate users attempting to access Administrator Level privileges on the Switch. The user may set a password of up to 15 characters.
Confirm Local Enable Password	Confirm the new password entered above. Entering a different password here from the one set in the New Local Enabled field will result in a fail message.

Click **Apply** to implement changes made.

Enable Admin

Users who have logged on to the Switch on the normal user level and wish to be promoted to the administrator level can use this window. After logging on to the Switch, users will have only user level privileges. To gain access to administrator level privileges, the user will open this window and will have to enter an authentication password. Possible authentication methods for this function include TACACS/XTACACS/TACACS+/RADIUS, user defined server groups, local enable (local account on the Switch), or no authentication (none). Because XTACACS and TACACS do not support the enable function, the user must create a special account on the server host, which has the username "enable", and a password configured by the administrator that will support the "enable" function. This function becomes inoperable when the authentication policy is disabled.

To view the following window, click **Security > Access Authentication Control > Enable Admin**:

Figure 5 - 42. Enable Admin window

When this window appears, click the **Enable Admin** button revealing a window for the user to enter authentication (password, username), as seen below. A successful entry will promote the user to Administrator level privileges on the Switch.

MAC-based Access Control

MAC-based Access Control is a method to authenticate and authorize access using either a port or host. For port-based MAC, the method decides port access rights, while for host-based MAC, the method determines the MAC access rights.

A MAC user must be authenticated before being granted access to a network. Both local authentication and remote RADIUS server authentication methods are supported. In MAC-based Access Control, MAC user information in a local database or a RADIUS server database is searched for authentication. Following the authentication result, users achieve different levels of authorization.

Notes about MAC-based Access Control

There are certain limitations and regulations regarding MAC-based Access Control:

1. Once this feature is enabled for a port, the Switch will clear the FDB of that port.
2. If a port is granted clearance for a MAC address in a VLAN that is not a Guest VLAN, other MAC addresses on that port must be authenticated for access and otherwise will be blocked by the Switch.
3. A port accepts a maximum of sixteen authenticated MAC addresses per physical port of a VLAN that is not a Guest VLAN. Other MAC addresses attempting authentication on a port with the maximum number of authenticated MAC addresses will be blocked.
4. Ports that have been enabled for Link Aggregation, Port Security, or GVRP authentication cannot be enabled for MAC-based Authentication.

MAC-based Access Control Settings

This window is used to set the parameters for the MAC-based Access Control function on the Switch. The user can set the running state, method of authentication, RADIUS password, view the Guest VLAN configuration to be associated with the MAC-based Access Control function of the Switch, and configure ports to be enabled or disabled for the MAC-based Access Control feature of the Switch. Please remember, ports enabled for certain other features, listed previously, can not be enabled for MAC-based Access Control.

To view the following window, click **Security** > **MAC-based Access Control** > **MAC-based Access Control Global Settings**:

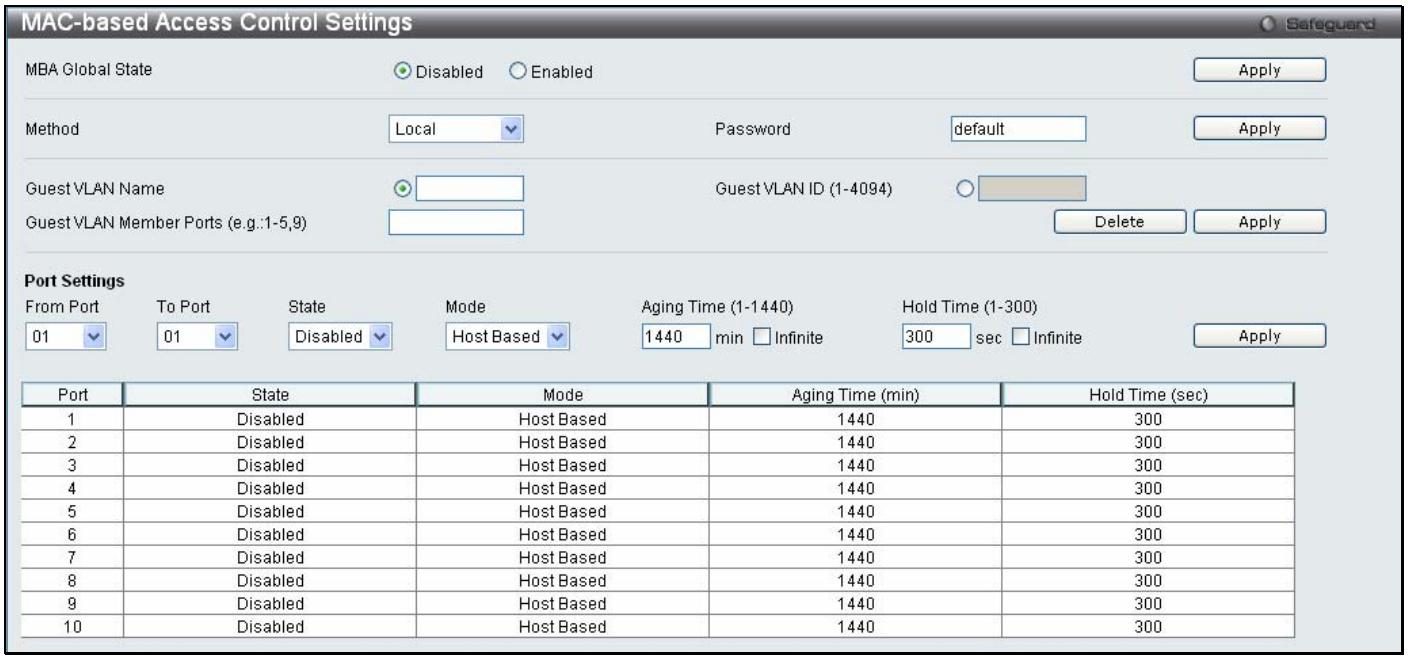


Figure 5 - 43. MAC-based Access Control Settings window

To configure a port or range of ports for the MAC-based Access Control feature, use the From Port and To Port drop-down menus to choose the ports, and then use the State drop-down menu to enable them. The following parameters may be viewed or set:

Parameter	Description
MBA Global State	Toggle to globally enable or disable the MAC-based Access Control function on the Switch.
Method	Use this drop-down menu to choose the type of authentication to be used when authentication MAC addresses on a given port. The user may choose between the following methods: *Local* – Use this method to utilize the locally set MAC address database as the authenticator for MAC-based Access Control. This MAC address list can be configured in the MAC-based Access Control Local Database Settings window. *RADIUS* – Use this method to utilize a remote RADIUS server as the authenticator for MAC-based Access Control. Remember, the MAC list must be previously set on the RADIUS server and the settings for the server must be first configured on the Switch.
Password	Enter the password for the RADIUS server, which is to be used for packets being sent requesting authentication. The default password is “default”.
Guest VLAN Name	Enter the name of the previously configured Guest VLAN being used for this function.
Guest VLAN Member Ports (e.g.: 1-5, 9)	Enter the list of ports that have been configured for the Guest VLAN.
Guest VLAN ID (1-4904)	Click the button and enter a Guest VLAN ID.
From Port	The beginning port of a range of ports to be configured for MAC-based Access Control.
To Port	The ending port of a range of ports to be configured for MAC-based Access Control.
State	Use this drop-down menu to enable or disable MAC-based Access Control on the port or range of ports selected in the Port Settings section of this window.
Mode	Toggle between *Port Based* and *Host Based*.
Aging Time (1-1440)	Enter a value between *1* and *1440* minutes. The default is *1440*.
Hold Time (1-300)	Enter a value between *1* and *300* seconds. The default is *300*.

Click **Apply** to implement the configuration changes.

MAC-based Access Control Local Settings

Users can set a list of MAC addresses, along with their corresponding target VLAN, which will be authenticated for the Switch. Once a queried MAC address is matched in this window, it will be placed in the VLAN associated with it here. The Switch administrator may enter up to 128 MAC addresses to be authenticated using the local method configured here.

To view the following window, click **Security** > **MAC-based Access Control** > **MAC-based Access Control Local Settings**:

Figure 5 - 44. MAC-based Access Control Local Settings window

To add a MAC address to the local authentication list, enter the MAC address and the target VLAN Name into their appropriate fields and click **Add**. To change a MAC address or a VLAN in the list, enter its parameters into the appropriate fields and click **Edit**. To delete a MAC address entry, enter its parameters into the appropriate fields and click **Delete By MAC**. To delete a VLAN Name, enter its parameters into the appropriate fields and click **Delete By VLAN**. To search for a specific MAC Address, enter the MAC address in the first field and then click the **Find By MAC** button. To search for a specific VLAN Name, enter the VLAN name in the second field and then click the **Find By VLAN** button.

Web-based Access Control (WAC)

Web-based Authentication Login is a feature designed to authenticate a user when the user is trying to access the Internet via the Switch. The authentication process uses the HTTP protocol. The Switch enters the authenticating stage when users attempt to browse Web pages (e.g, http://www.dlink.com) through a Web browser. When the Switch detects HTTP packets and this port is un-authenticated, the Switch will launch a pop-up user name and password window to query users. Users are not able to access the Internet until the authentication process is passed.

The Switch can be the authentication server itself and do the authentication based on a local database, or be a RADIUS client and perform the authentication process via the RADIUS protocol with a remote RADIUS server. The client user initiates the authentication process of WAC by attempting to gain Web access.

D-Link's implementation of WAC uses a virtual IP that is exclusively used by the WAC function and is not known by any other modules of the Switch. In fact, to avoid affecting a Switch's other features, WAC will only use a virtual IP address to communicate with hosts. Thus, all authentication requests must be sent to a virtual IP address but not to the IP address of the Switch's physical interface.

Virtual IP works like this, when a host PC communicates with the WAC Switch through a virtual IP, the virtual IP is transformed into the physical IPIF (IP interface) address of the Switch to make the communication possible. The host PC and other servers' IP configurations do not depend on the virtual IP of WAC. The virtual IP does not respond to any ICMP packets or ARP requests, which means it is not allowed to configure a virtual IP on the same subnet as the Switch's IPIF (IP interface) or the same subnet as the host PCs' subnet.

As all packets to a virtual IP from authenticated and authenticating hosts will be trapped to the Switch's CPU, if the virtual IP is the same as other servers or PCs, the hosts on the WAC-enabled ports cannot communicate with the server or PC which really own the IP address. If the hosts need to access the server or PC, the virtual IP cannot be the same as the one of the server or PC. If a host PC uses a proxy to access the Web, to make the authentication work properly the user of the PC should add the virtual IP to the exception of the proxy configuration. Whether or not a virtual IP is specified, users can access the WAC pages through the Switch's system IP. When a virtual IP is not specified, the authenticating Web request will be redirected to the Switch's system IP.

The Switch's implementation of WAC features a user-defined port number that allows the configuration of the TCP port for either the HTTP or HTTPS protocols. This TCP port for HTTP or HTTPs is used to identify the HTTP or HTTPs packets that will be trapped to the CPU for authentication processing, or to access the login page. If not specified, the default port number for HTTP is 80 and the default port number for HTTPS is 443. If no protocol is specified, the default protocol is HTTP.

The following diagram illustrates the basic six steps all parties go through in a successful Web Authentication process:

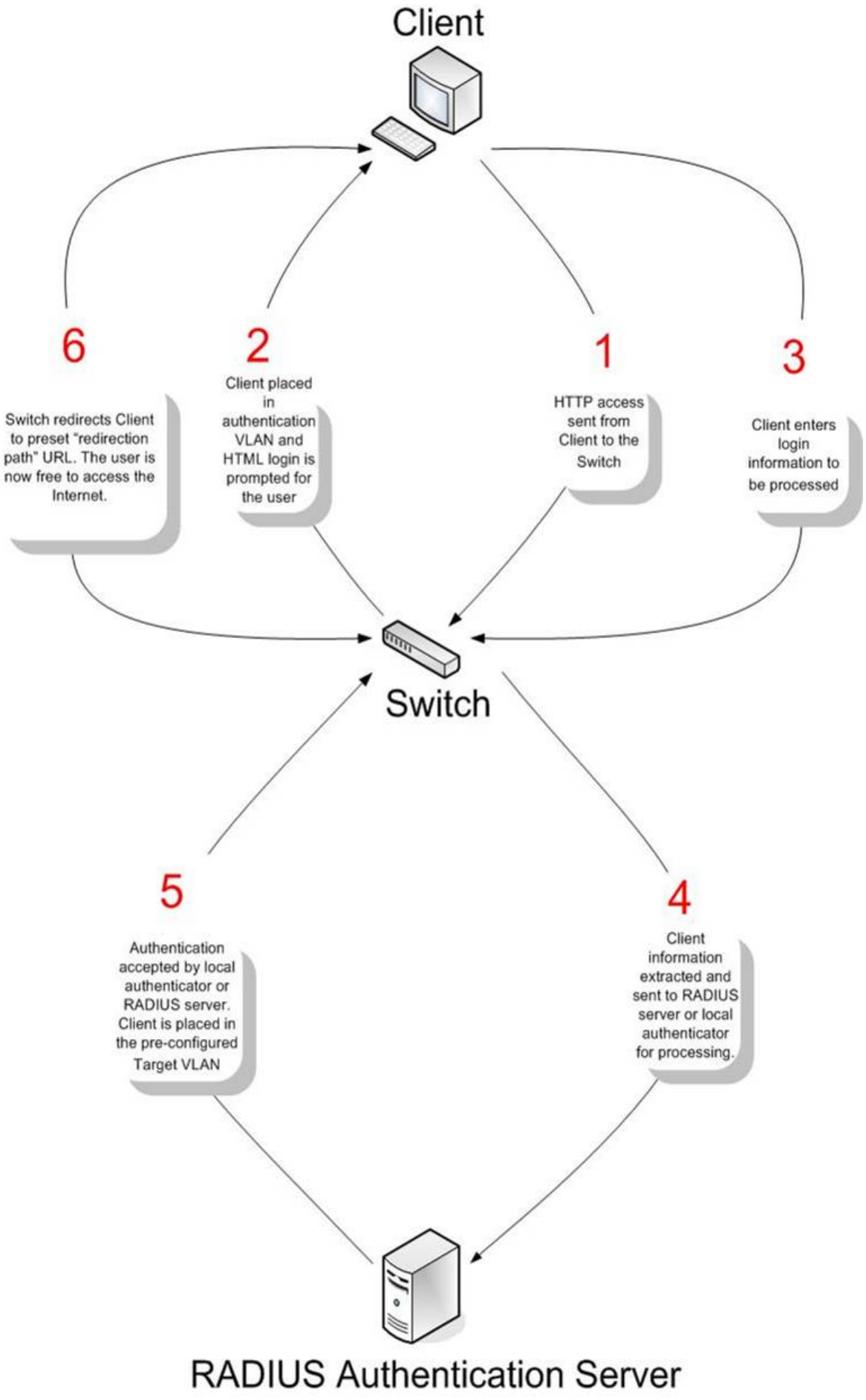

Client
6
Switch redirects Client to preset "redirection path" URL. The user is now free to access the Internet.
2
Client placed in authentication VLAN and HTML login is prompted for the user
1
HTTP access sent from Client to the Switch
3
Client enters login information to be processed
Switch
5
Authentication accepted by local authenticator or RADIUS server. Client is placed in the pre-configured Target VLAN
4
Client information extracted and sent to RADIUS server or local authenticator for processing.
RADIUS Authentication Server

Figure 5 - 45. Six Basic Steps in a Successful Web Authentication Process

Conditions and Limitations

1. If the client is utilizing DHCP to attain an IP address, the authentication VLAN must provide a DHCP server or a DHCP relay function so that client may obtain an IP address.
2. Certain functions exist on the Switch that will filter HTTP packets, such as the Access Profile function. The user needs to be very careful when setting filter functions for the target VLAN, so that these HTTP packets are not denied by the Switch.
3. If a RADIUS server is to be used for authentication, the user must first establish a RADIUS Server with the appropriate parameters, including the target VLAN, before enabling Web Authentication on the Switch.

WAC Global Settings

Users can configure the Switch for Web authentication.

To view the following window, click **Security** > **Web Authentication** > **WAC Global Settings**:

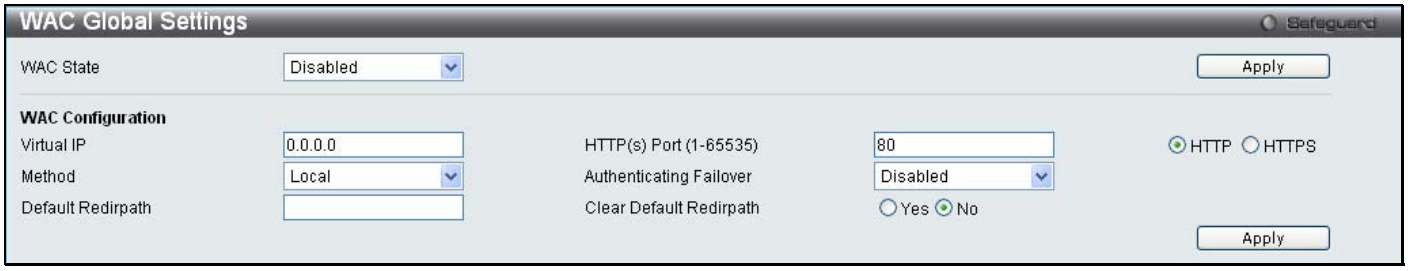


Figure 5 - 46. WAC Global Settings window

To set the Web Authentication for the Switch, complete the following fields:

Parameter	Description
WAC State	Use this drop-down menu to either enable or disable the Web Authentication on the Switch.
Virtual IP	Enter a virtual IP address. This address is only used by WAC and is not known by any other modules of the Switch.
HTTP(s) Port (1-65535)	Enter a HTTP port number. Port *80* is the default.
Method	Use this drop-down menu to choose the authenticator for Web-based Access Control. The user may choose: *Local* – Choose this parameter to use the local authentication method of the Switch as the authenticating method for users trying to access the network via the switch. This is, in fact, the username and password to access the Switch configured using the **WAC User Settings** window (**Security** > **Web Authentication** > **WAC User Settings**) seen below. *RADIUS* – Choose this parameter to use a remote RADIUS server as the authenticating method for users trying to access the network via the switch. This RADIUS server must have already been pre-assigned by the administrator using the **Authentic RADIUS Server** window (**Security** > **802.1X** > **Authentic RADIUS Server**).
Authenticating Failover	Toggle between *Enabled* and *Disabled*. This is used to configure WAC authentication failover. By default, the authentication failover is disabled. If RADIUS servers are unreachable, the authentication will fail. When the authentication failover is enabled, if RADIUS server authentication is unreachable, the local database will be used to do the authentication.
Redirection Page	Enter the URL of the website that authenticated users placed in the VLAN are directed to once authenticated. This path must be entered into this field before the Web-based Access Control can be enabled.

Click **Apply** to implement changes made.

NOTE: To enable the Web Authentication function, the redirection path field must have the URL of the website that users will be directed to once they enter the limited resource, pre-configured VLAN. Users that attempt to apply settings without the Redirection Page field set will be prompted with an error message and Web Authentication will not be enabled. The URL should follow the form http(s)://www.dlink.com

NOTE: The subnet of the IP address of the authentication VLAN must be the same as that of the client, or the client will always be denied authentication.

NOTE: A successful authentication should direct the client to the stated web page. If the client does not reach this web page, yet does not receive a **Fail!** Message, the client will already be authenticated and therefore should refresh the current browser window or attempt to open a different web page.

WAC User Settings

Users can view and set user accounts for Web authentication.

To view the following window, click **Security > Web Authentication > WAC User Settings**:

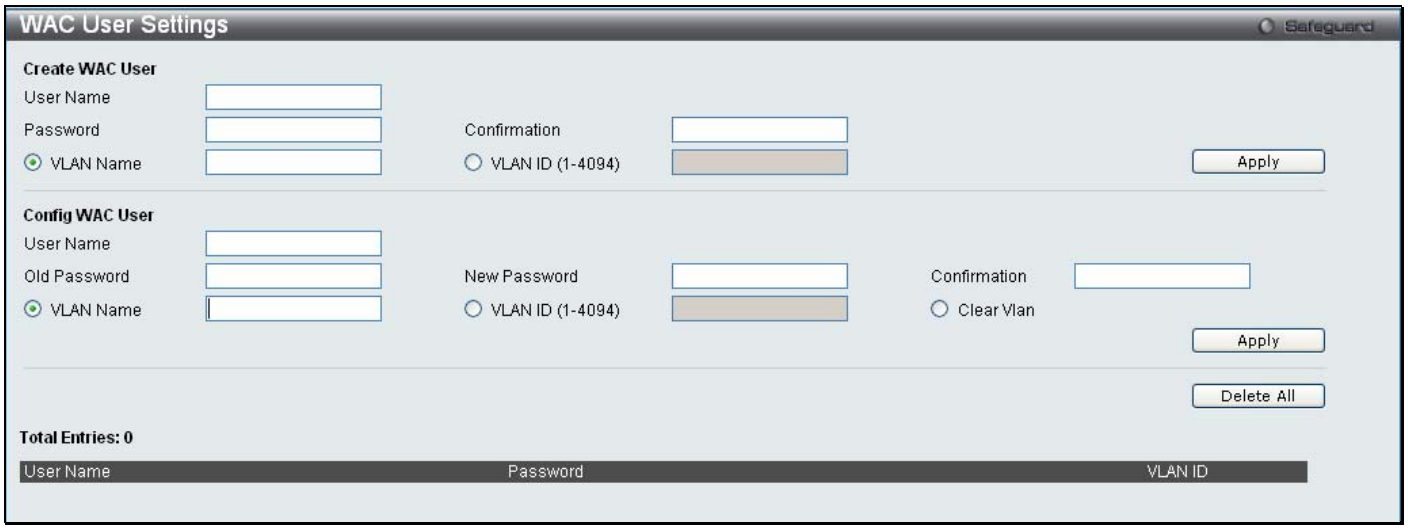


Figure 5 - 47. WAC User Settings window

To set the User Account settings for the Web authentication by the Switch, complete the following fields:

Parameter	Description
Create WAC User	
User Name	Enter the user name of up to 15 alphanumeric characters of the guest wishing to access the Web through this process. This field is for administrators who have selected *Local* as their Web-based authenticator.
Password	Enter the password the administrator has chosen for the selected user. This field is case-sensitive and must be a complete alphanumeric string. This field is for administrators who have selected *Local* as their Web-based authenticator.

Confirmation	Retype the password entered in the previous field.
VLAN Name	Click the button and enter a VLAN Name in this field.
VLAN ID (1-4094)	Click the button and enter a VID in this field.
Config WAC User	
User Name	Enter the user name that has been guest-authenticated through this process, to be mapped to a previously configured VLAN with limited rights.
Old Password	Enter the previous password in this field.
New Password	Enter the new password in this field.
Confirmation	Retype the password entered in the previous field.
VLAN Name	Enter the VLAN name of a previously configured VLAN to which a successfully authenticated Web user will be mapped.
VLAN ID (1-4094)	Click the button and enter a VID in this field.

Click **Apply** to implement changes made.

WAC Port Settings

Users can view and set port configurations for Web authentication.

To view the following window, click **Security > Web Authentication > WAC Port Settings**:

Figure 5 - 48. WAC Port Settings window

To set the WAC on individual ports for the Switch, complete the following fields:

Parameter	Description
From Port	Use this drop-down menu to select the beginning port of a range of ports to be enabled as WAC ports.
To Port	Use this drop-down menu to select the ending port of a range of ports to be enabled as WAC ports.
Aging Time (1-1440)	This parameter specifies the time period during which an authenticated host will remain in the authenticated state. Enter a value between *0* and *1440* minutes. A value of *0* indicates the authenticated host will never age out on the port. The default value is *1440* minutes (24

	hours).
State	Use this drop-down menu to enable the configured ports as WAC ports.
Idle Time (1-1440)	If there is no traffic during the Idle Time parameter, the host will be moved back to the unauthenticated state. Enter a value between *0* and *1440* minutes. A value of *0* indicates the Idle state of the authenticated host on the port will never be checked. The default value is *infinite*.
Block Time (0-300)	This parameter is the period of time a host will be blocked if it fails to pass authentication. Enter a value between *0* and *300* seconds. The default value is *30* seconds.

Click **Apply** to implement changes made.

JWAC

The **JWAC** folder contains five windows: **JWAC Global Settings**, **JWAC Port Settings**, **JWAC User Settings**, **JWAC Customize Page Language**, and **JWAC Customize Page**.

JWAC Global Settings

Users can enable and configure Japanese Web-based Access Control on the Switch. Please note that JWAC and Web Authentication are mutually exclusive functions. That is, they cannot be enabled at the same time. To use the JWAC feature, computer users need to pass through two stages of authentication. The first stage is to do the authentication with the quarantine server and the second stage is the authentication with the Switch. For the second stage, the authentication is similar to Web Authentication, except that there is no port VLAN membership change by JWAC after a host passes authentication. The RADIUS server will share the server configuration defined by the 802.1X command set.

To view the following window, click **Security** > **JWAC** > **JWAC Global Settings**:

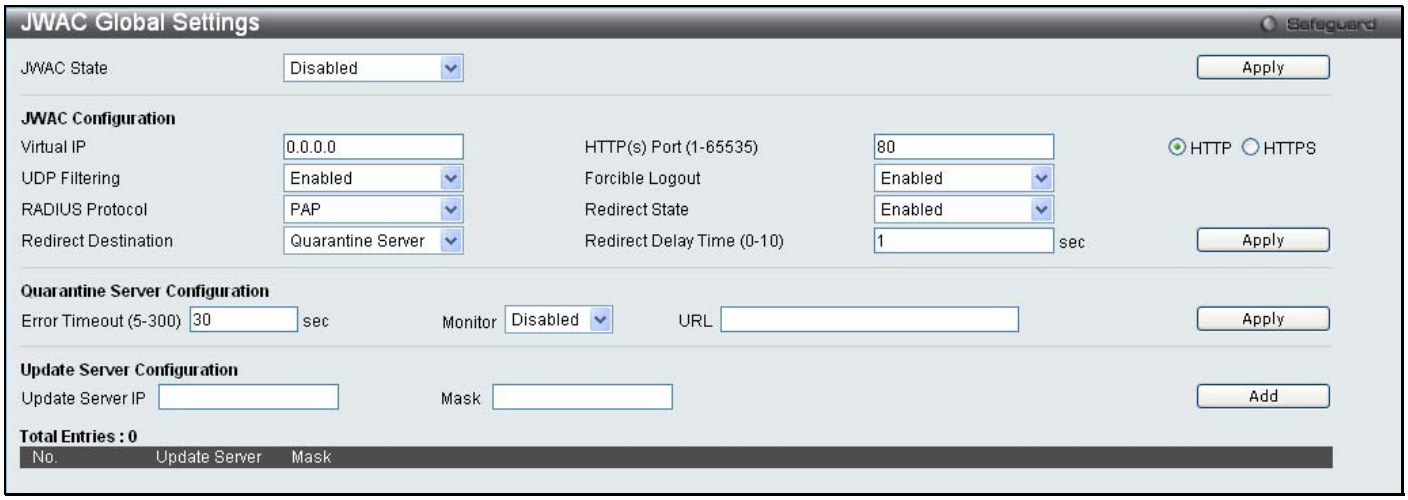


Figure 5 - 49. JWAC Global Settings window

To set the Web authentication for the Switch, complete the following fields:

Parameter	Description
JWAC State	Use this drop-down menu to either enable or disable JWAC on the Switch.
JWAC Configuration	
Virtual IP	This parameter specifies the JWAC Virtual IP address that is used to accept authentication requests from an unauthenticated host. The Virtual IP address of JWAC is used to accept authentication requests from an unauthenticated host. Only requests sent to this IP will get a

	correct response. NOTE: This IP does not respond to ARP requests or ICMP packets.
HTTP(s) Port (1-65535)	This parameter specifies the TCP port that the JWAC Switch listens to and uses to finish the authenticating process.
UDP Filtering	This parameter enables or disables JWAC UDP Filtering. When UDP Filtering is *Enabled*, all UDP and ICMP packets except DHCP and DNS packets from unauthenticated hosts will be dropped.
Forcible Logout	This parameter enables or disables JWAC Forcible Logout. When Forcible Logout is *Enabled*, a Ping packet from an authenticated host to the JWAC Switch with TTL=1 will be regarded as a logout request, and the host will move back to the unauthenticated state.
RADIUS Protocol	This parameter specifies the RADIUS protocol used by JWAC to complete a RADIUS authentication. The options include *Local*, *EAP MD5*, *PAP*, *CHAP*, *MS CHAP*, and *MS CHAPv2*.
Redirect State	This parameter enables or disables JWAC Redirect. When the redirect quarantine server is enabled, the unauthenticated host will be redirected to the quarantine server when it tries to access a random URL. When the redirect JWAC login page is enabled, the unauthenticated host will be redirected to the JWAV login page in the Switch to finish authentication. When redirect is disabled, only access to the quarantine server and the JWAC login page from the unauthenticated host are allowed, all other web access will be denied. NOTE: When enabling redirect to the quarantine server, a quarantine server must be configured first.
Redirect Destination	This parameter specifies the destination before an unauthenticated host is redirected to either the *Quarantine Server* or the *JWAC Login Page*.
Redirect Delay Time (0-10)	This parameter specifies the Delay Time before an unauthenticated host is redirected to the Quarantine Server or JWAC Login Page. Enter a value between *0* and *10* seconds. A value of *0* indicates no delay in the redirect.
Quarantine Server Configuration	
Error Timeout (5-300)	This parameter is used to set the Quarantine Server Error Timeout. When the Quarantine Server Monitor is enabled, the JWAC Switch will periodically check if the Quarantine works okay. If the Switch does not receive any response from the Quarantine Server during the configured Error Timeout, the Switch then regards it as not working properly. Enter a value between *5* and *300* seconds.
Monitor	This parameter enables or disables the JWAC Quarantine Server Monitor. When *Enabled*, the JWAC Switch will monitor the Quarantine Server to ensure the server is okay. If the Switch detects no Quarantine Server, it will redirect all unauthenticated HTTP access attempts to the JWAC Login Page forcibly if the Redirect is enabled and the Redirect Destination is configured to be a Quarantine Server.
URL	This parameter specifies the JWAC Quarantine Server URL. If the Redirect is enabled and the Redirect Destination is the Quarantine Server, when an unauthenticated host sends the HTTP request packets to a random Web server, the Switch will handle this HTTP packet and send back a message to the host to allow it access to the Quarantine Server with the configured URL. When a computer is connected to the specified URL, the quarantine server will request the computer user to input the user name and password to complete the authentication process.
Update Server Configuration	
Update Server IP	This parameter specifies the Update Server IP address.
Mask	This parameter specifies the Server IP net mask.

Click **Apply** to implement changes made.

JWAC Port Settings

Users can configure JWAC port settings for the Switch.

To view the following window, click **Security** > **JWAC** > **JWAC Port Settings**:

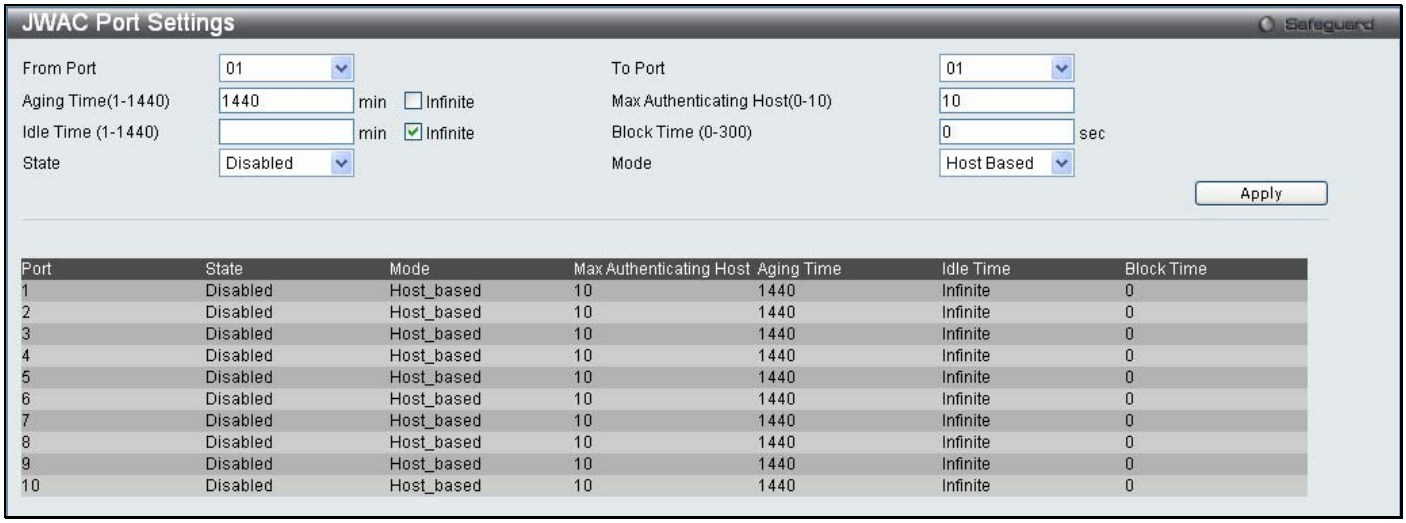


Figure 5 - 50. JWAC Port Settings window

To set the JWAC on individual ports for the Switch, complete the following fields:

Parameter	Description
From Port	Use this drop-down menu to select the beginning port of a range of ports to be enabled as JWAC ports.
To Port	Use this drop-down menu to select the ending port of a range of ports to be enabled as JWAC ports.
Aging Time (1-1440)	This parameter specifies the time period during which an authenticated host will remain in the authenticated state. Enter a value between *0* and *1440* minutes or tick the Infinite check box. The default value is *1440*. A value of *0* indicates the authenticated host will never age out on the port.
MAC Authenticating Host (1-10)	This parameter specifies the maximum number of host process authentication attempts allowed on each port at the same time. The default value is *10*. Enter a value between *1* and *10* attempts.
Idle Time (1-1440)	If there is no traffic during the Idle Time parameter, the host will be moved back to the unauthenticated state. The default value is infinite. To change this value, first untick the Infinite check box and then enter a value between *0* and *1440* minutes. A value of *0* indicates the Idle state of the authenticated host on the port will never be checked.
Block Time (0-300)	This parameter is the period of time a host will be blocked if it fails to pass authentication. Enter a value between *0* and *300* seconds. The default value is *0*.
Mode	Toggle between *Host Based* and *Port Based*.
State	Use this drop-down menu to enable the configured ports as JWAC ports.

Click **Apply** to implement changes made.

JWAC User Settings

Users can configure JWAC user settings for the Switch.

To view the following window, click **Security** > **JWAC** > **JWAC User Settings**:

Figure 5 - 51. JWAC User Settings window

To set the User Account settings for the JWAC by the Switch, complete the following fields and then click the **Add** button. To clear the current JWAC user settings in the table at the bottom of the window, click the **Delete All** button.

Parameter	Description
User Name	Enter a username of up to 15 alphanumeric characters.
New Password	Enter the password the administrator has chosen for the selected user. This field is case-sensitive and must be a complete alphanumeric string.
Confirm Password	Retype the password entered in the previous field.
VID(1-4094)	Enter a VLAN ID number between *1* and *4094*.

Click **Apply** to implement changes made.

JWAC Customize Page Language

Users can configure JWAC page and language settings for the Switch. The current firmware supports either English or Japanese.

To view the following window, click **Security** > **JWAC** > **JWAC Customize Page Language**:

Figure 5 - 52. JWAC Customize Page Language window

To set the language used on the JWAC page, click the radio button for either English or Japanese. Click the **Apply** button.

JWAC Customize Page

Users can configure JWAC page settings for the Switch.

To view the following window, click **Security** > **JWAC** > **JWAC Customize Page**:

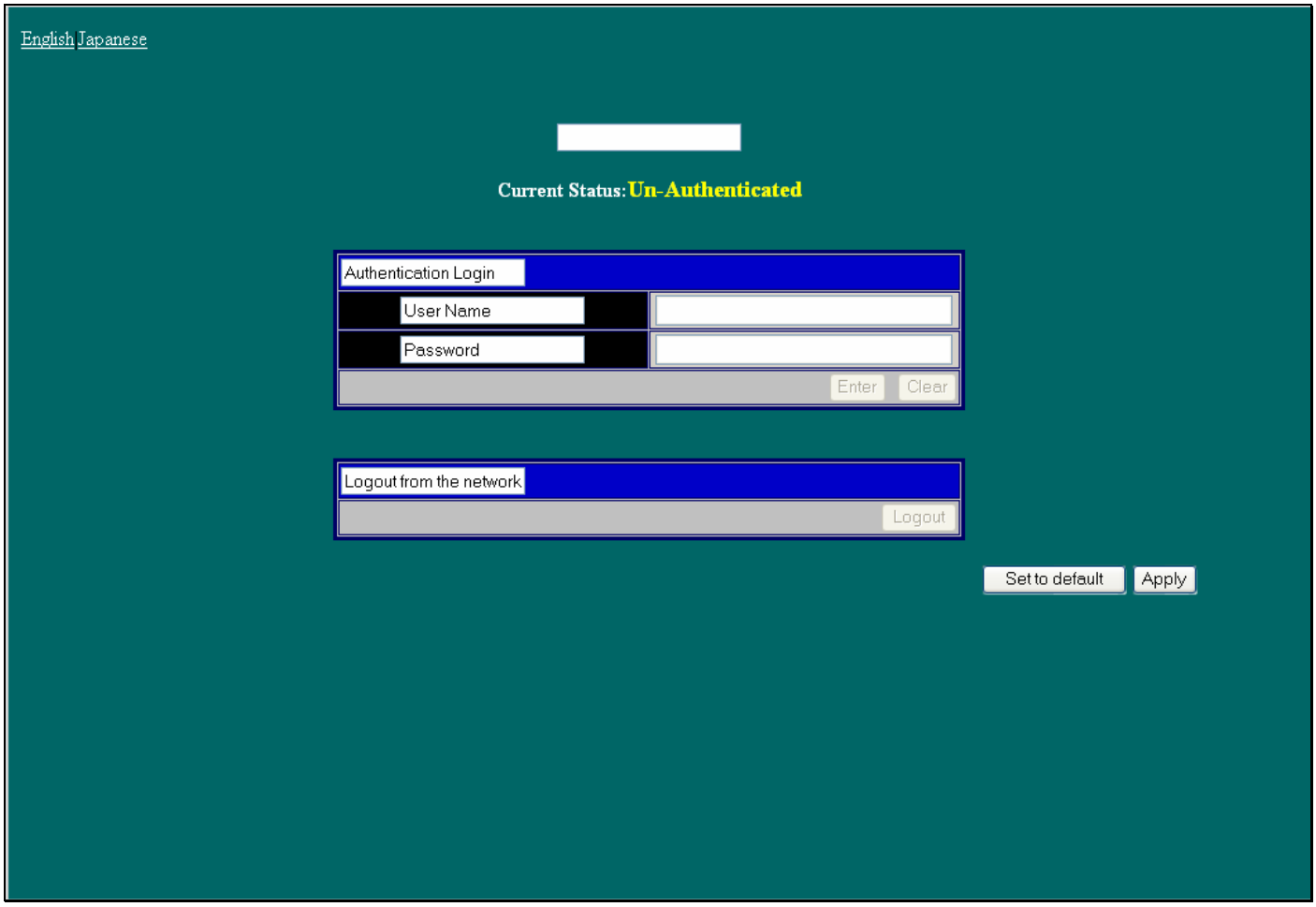


Figure 5 - 53. JWAC Customize Page window

Complete the JWAC authentication information on this window to set the JWAC page settings. Enter a name for the Authentication in the first field and then click the **Apply** button. Next, enter a User Name and a Password and then click the **Enter** button.

Multiple Authentication

Modern networks employ many authentication methods. The Multiple Authentication methods supported by this Switch include 802.1X, MAC-based Access Control (MBAC), Web-based Access Control (WAC), Japan Web-based Access Control (JWAC), and IP-MAC-Port Binding (IMPB). The Multiple Authentication feature allows clients running different authentication methods to connect to the network using the same switch port.

The Multiple Authentication feature can be implemented using one of the following modes:

Any (MAC, 802.1X or WAC) Mode

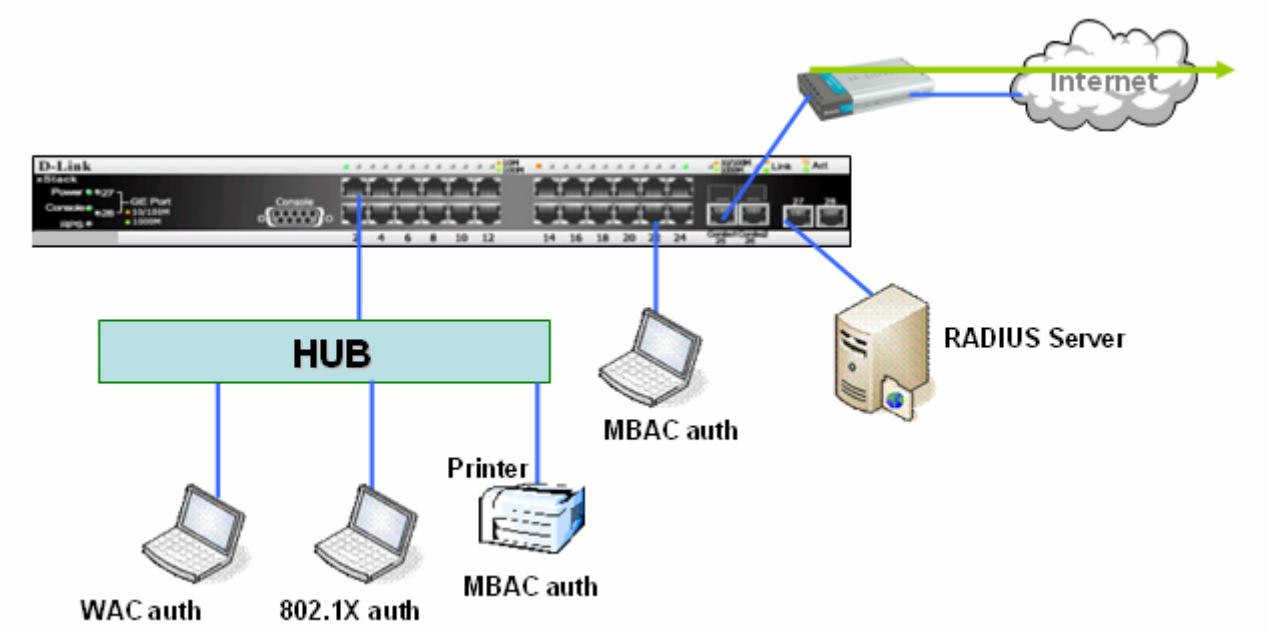


Figure 5 - 54. Any (MAC, 802.1X or WAC) Mode

In the diagram above the Switch port has been configured to allow clients to authenticate using 802.1X, MBAC, or WAC. When a client tries to connect to the network, the Switch will try to authenticate the client using one of these methods and if the client passes they will be granted access to the network.

Any (MAC, 802.1X or JWAC) Mode

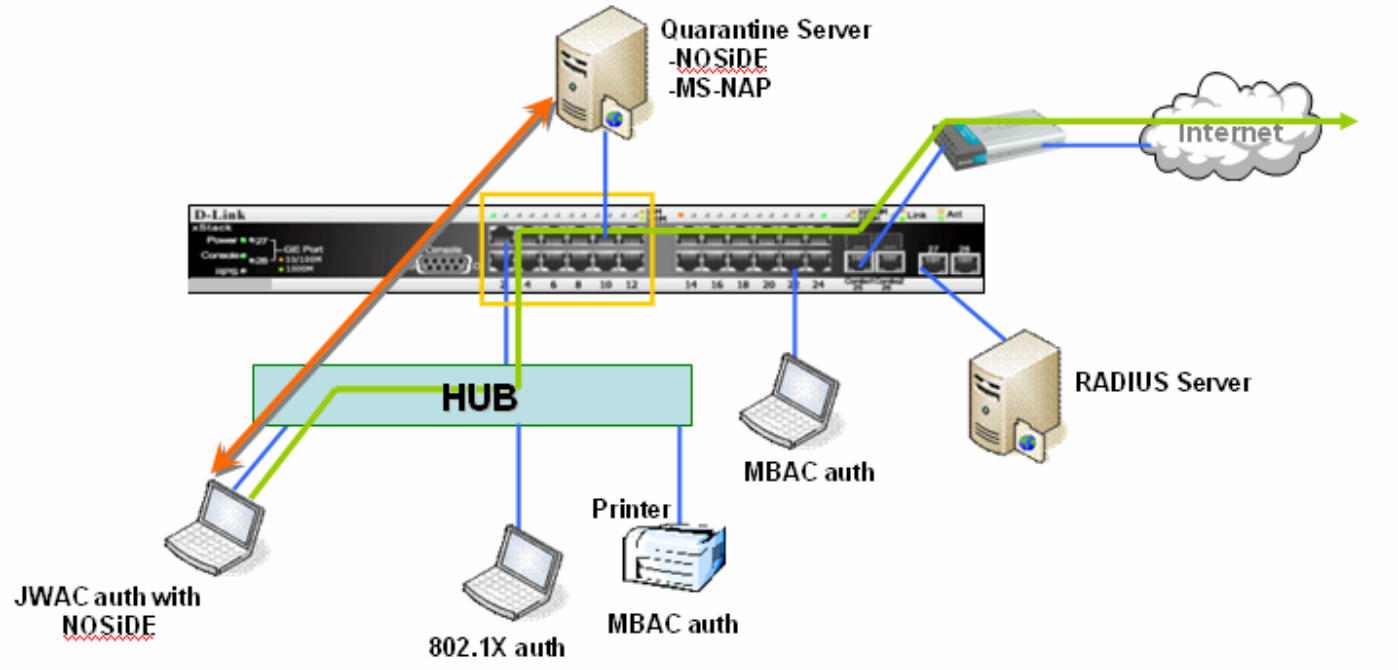


Figure 5 - 55. Any (MAC, 802.1X or JWAC) Mode

In the diagram above the Switch port has been configured to allow clients to authenticate using 802.1X, MBAC, or JWAC. When a client tries to connect to the network, the Switch will try to authenticate the client using one of these methods and if the client passes they will be granted access to the network.

802.1X & IMPB Mode

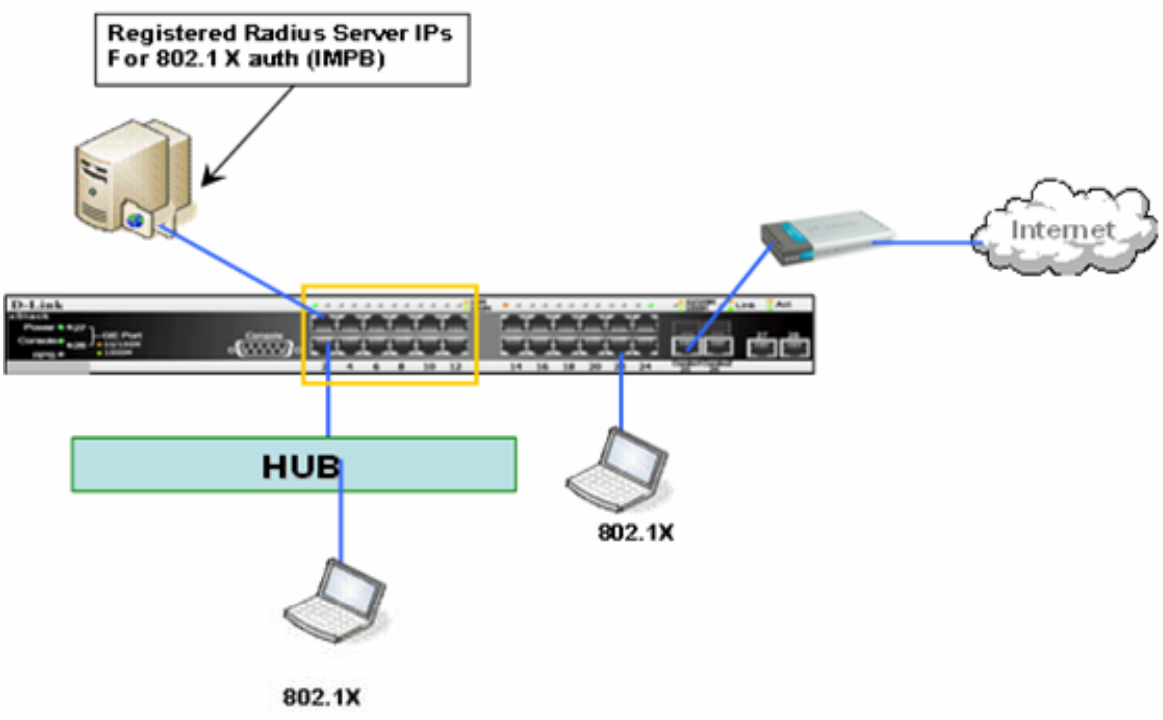


Figure 5 - 56. 802.1X & IMPB Mode

This mode adds an extra layer of security by checking the IP MAC-Binding Port Binding (IMPB) table before trying one of the supported authentication methods. The IMPB Table is used to create a 'white list' that checks if the IP streams being sent by authorized hosts have been granted or not. In the above diagram the Switch port has been configured to allow clients to authenticate using 802.1X. If the client is in the IMPB table and tries to connect to the network using this authentication method and the client is listed in the white list for legal IP/MAC/port checking, access will be granted. If a client fails one of the authentication methods, access will be denied.

IMPB & WAC/JWAC Mode

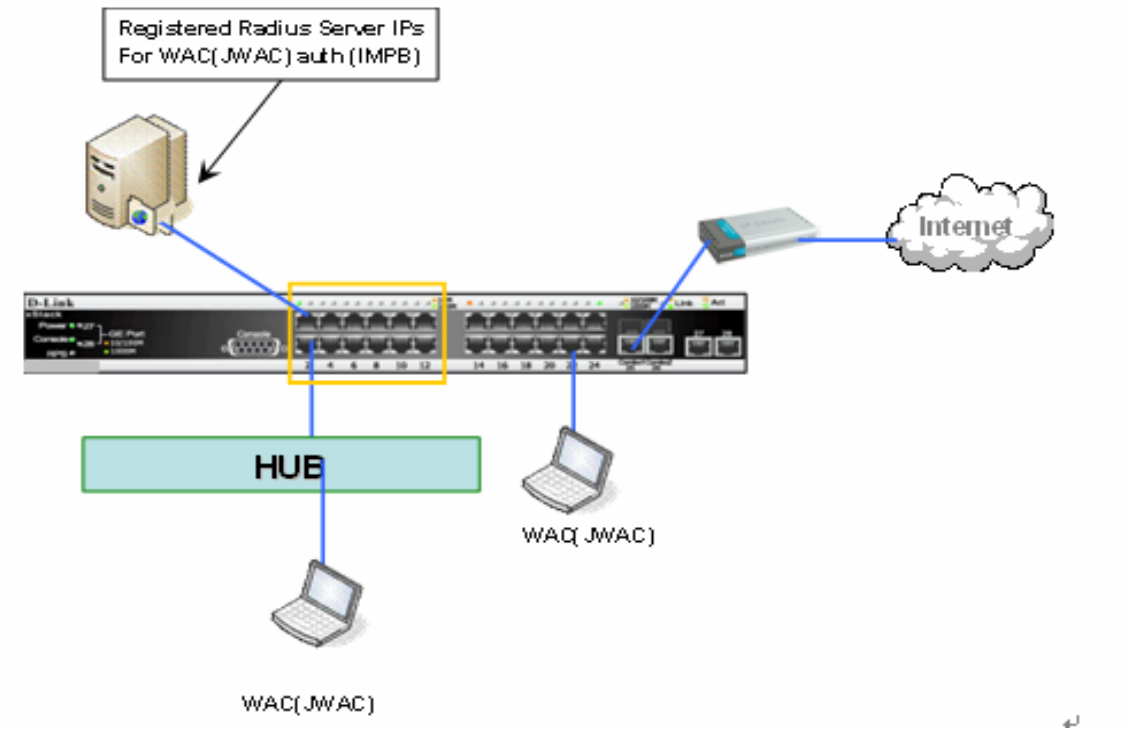


Figure 5 - 57. IMPB & WAC/JWAC Mode

This mode adds an extra layer of security by checking the IP MAC-Binding Port Binding (IMPB) table before trying one of the supported authentication methods. The IMPB Table is used to create a 'white-list' that checks if the IP streams being sent by authorized hosts have been granted or not. In the above diagram, the Switch port has been configured to allow clients to authenticate using either WAC or JWAC. If the client is in the IMPB table and tries to connect to the network using either of these supported authentication methods and the client is listed in the white list for legal IP/MAC/port checking, access will be granted. If a client fails one of the authentication methods, access will be denied.

The **Multiple Authentication** folder contains three windows: **Authorization Network State Settings**, **Multiple Authentication Settings**, and **Guest VLAN Settings**.

Authorization Network State Settings

Users can configure Authorization Network State Settings for the Switch.

To view the following window, click **Security > Multiple Authentication > Authorization Network State Settings**:

Figure 5 - 58. Authorization Network State Settings window

Multiple Authentication Settings

Users can configure multiple authentication methods for a port or ports.

To view the following window, click **Security > Multiple Authentication > Multiple Authentication Settings**:

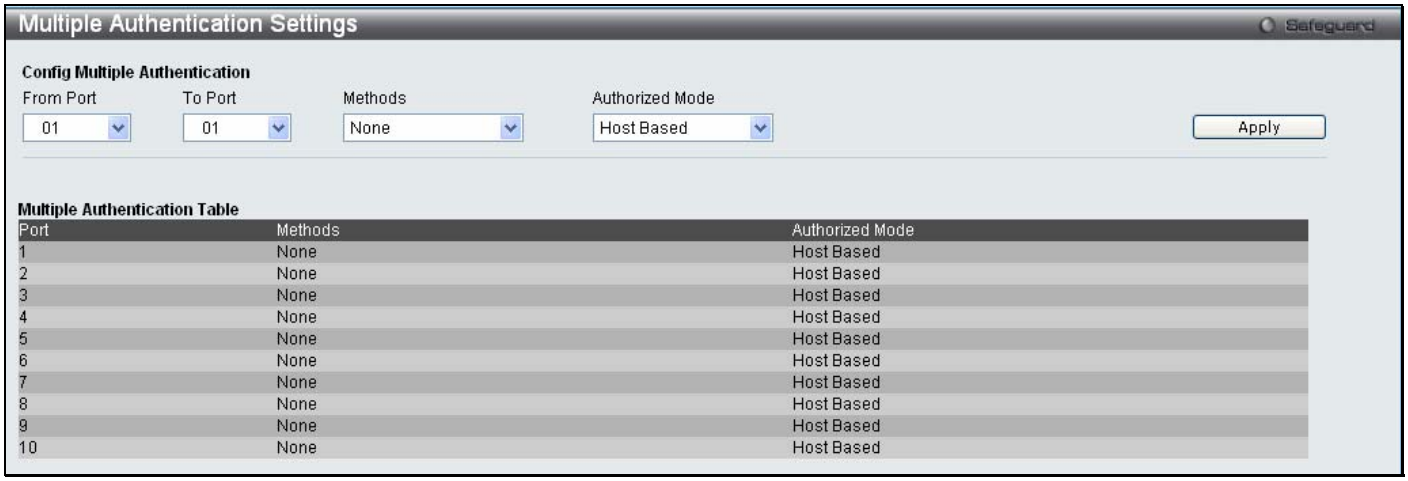


Figure 5 - 59. Multiple Authentication Settings window

To set up multiple authentication on individual ports for the Switch, complete the following fields:

Parameter	Description
From Port	Use this drop-down menu to select the beginning port of a range of ports to be enabled as multiple authentication ports.
To Port	Use this drop-down menu to select the ending port of a range of ports to be enabled as multiple authentication ports.
Methods	The multiple authentication method options include: *None*, *Any (MAC, 802.1X or WAC/JWAC)*, *802.1X+IMPB*, *IMPB+JWAC*, and *IMPB+WAC*. • *None* means all multiple authentication methods are disabled. • *Any (MAC, 802.1X or WAC/JWAC)* means if any of the authentication methods pass, then access will be granted. In this mode, MBAC, 802.1X and WAC/JWAC)

	can be enabled on a port at the same time. In *Any (MAC, 802.1X or WAC/JWAC* mode, whether an individual security module is active on a port depends on its system state. As system states of WAC and JWAC are mutually exclusive, only one of them will active on a port at the same time. • *802.1X+IMPB* means 802.1X will be verified first, and then IMPB will be verified. Both authentication methods need to be passed. • *IMPB+JWAC* means IMPB will be verified first, and then JWAC will be verified. Both authentication methods need to be passed. • *IMPB+WAC* means that IMPB will be verified first, and then WAC will be verified. Both authentication methods need to be passed.
Authorized Mode	Toggle between *Host Based* and *Port Based*. When *Port Based* is selected, if one of the attached hosts passes the authentication, all hosts on the same port will be granted access to the network. If the user fails the authorization, this port will keep trying the next authentication method. When *Host Based* is selected, users are authenticated individually.

Click **Apply** to implement the changes made.

Guest VLAN

Users can assign ports to or remove ports from a guest VLAN.

To view the following window, click **Security > Multiple Authentication > Guest VLAN**:

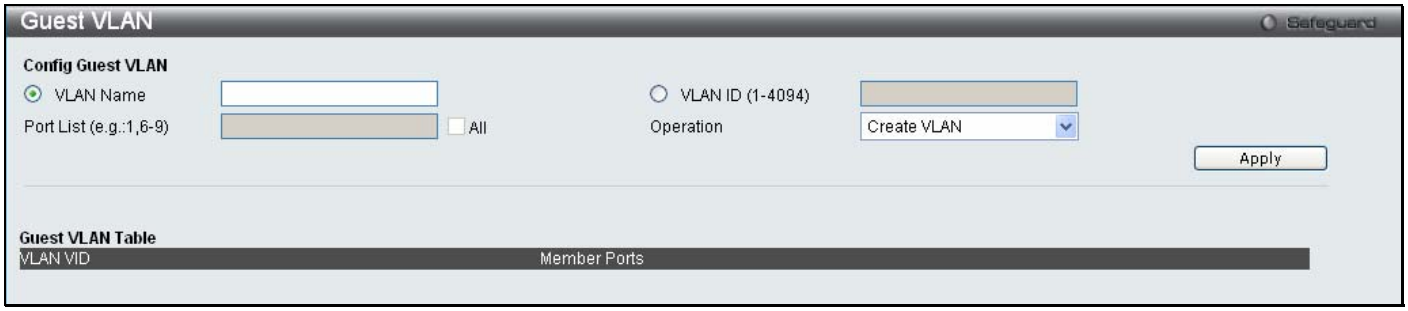


Figure 5 - 60. Guest VLAN window

The following fields may be modified to configure Guest VLANs:

Parameter	Description
VLAN Name	Click the button and assign a VLAN as a Guest VLAN. The VLAN must be an existing static VLAN.
VLAN ID (1-4094)	Click the button and assign a VLAN ID for a Guest VLAN. The VLAN must be an existing static VLAN before this VID can be configured.
Port List (e.g:1, 6-9)	The list of ports to be configured. Alternatively, tick the All check box to set every port at once.
Operation	Use the drop-down menu to choose the desired operation: *Create VLAN*, *Add Ports*, or *Delete Ports*.

Click **Apply** to implement the Guest VLAN. Once properly configured, the Guest VLAN and associated ports will be listed in the lower part of the window.

IGMP Access Control Settings (IGMP Authentication)

Users can set IGMP authentication, otherwise known as IGMP access control, on individual ports on the Switch. When the Authentication State is *Enabled*, and the Switch receives an IGMP join request, the Switch will send the access request to the RADIUS server to do the authentication.

IGMP authentication processes IGMP reports as follows: When a host sends a join message for the interested multicast group, the Switch has to do authentication before learning the multicast group/port. The Switch sends an Access-Request to an authentication server and the information including host MAC, switch port number, switch IP, and multicast group IP. When the Access-Accept is answered from the authentication server, the Switch learns the multicast group/port. When the Access-Reject is answered from the authentication server, the Switch won't learn the multicast group/port and won't process the packet further. The entry (host MAC, switch port number, and multicast group IP) is put in the "authentication failed list." When there is no answer from the authentication server after T1 time, the Switch resends the Access-Request to the server. If the Switch doesn't receive a response after N1 times, the result is denied and the entry (host MAC, switch port number, multicast group IP) is put in the "authentication failed list." In general case, when the multicast group/port is already learned by the switch, it won't do the authentication again. It only processes the packet as standard.

IGMP authentication processes IGMP leaves as follows: When the host sends leave message for the specific multicast group, the Switch follows the standard procedure for leaving a group and then sends an Accounting-Request to the accounting server for notification. If there is no answer from the accounting server after T2 time, the Switch resends the Accounting-Request to the server. The maximum number of retry times is N2.

To view the following window, click **Security** > **IGMP Access Control Settings**:

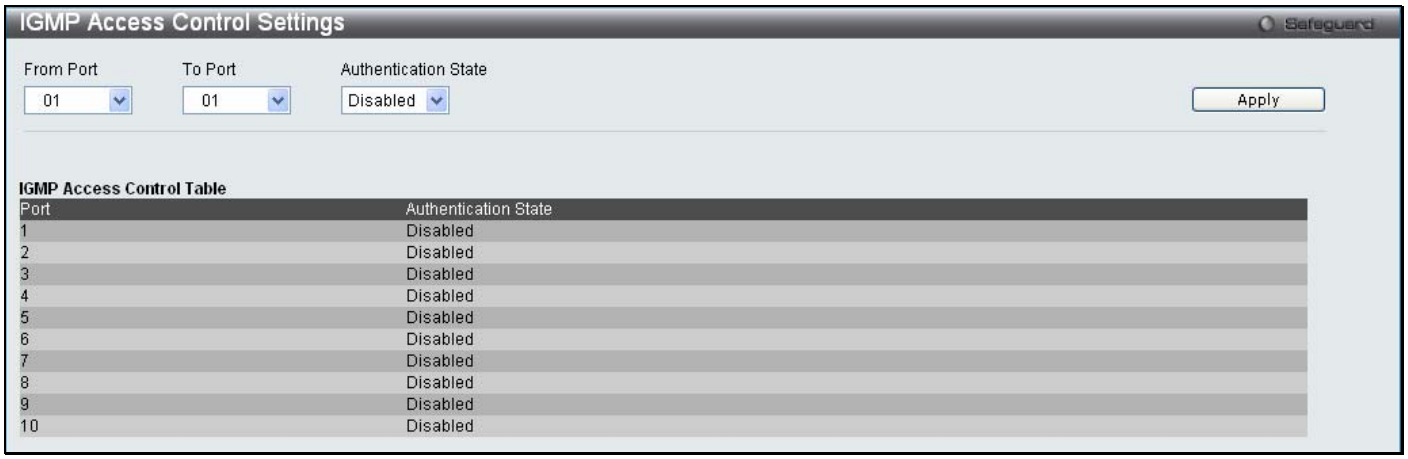


Figure 5 - 61. IGMP Access Control Settings window

To set up IGMP access control on individual ports for the Switch, complete the following fields:

Parameter	Description
From Port	Use this drop-down menu to select the beginning port of a range of ports to be enabled as IGMP access control ports.
To Port	Use this drop-down menu to select the ending port of a range of ports to be enabled as IGMP access control ports.
Authentication State	Toggle to enable and disable the RADIUS authentication function on the specified ports.

Click **Apply** to implement the changes made.

Section 6

ACL

Access Profile List

CPU Access Profile List

Time Range Settings

Access Profile List

Access profiles allow you to establish criteria to determine whether the Switch will forward packets based on the information contained in each packet's header.

The Switch supports four Profile Types, Ethernet ACL, IPv4 ACL, IPv6 ACL, and Packet Content ACL.

Creating an access profile is divided into two basic parts. The first is to specify which part or parts of a frame the Switch will examine, such as the MAC source address or the IP destination address. The second part is entering the criteria the Switch will use to determine what to do with the frame. The entire process is described below in two parts.

Users can display the currently configured Access Profiles on the Switch.

To view the following window, click **ACL** > **Access Profile List** (one access profile of each type has been created for explanatory purposes):

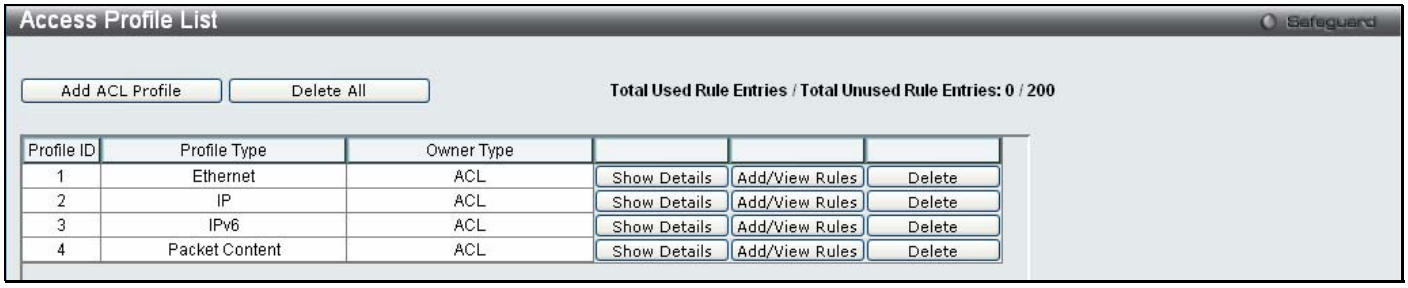


Figure 6 - 1. Access Profile List window

To add an entry to the **Access Profile List** window, click the **Add ACL Profile** button. To remove all access profiles from this table, click **Delete All**.

There are four **Add Access Profile** windows; one for Ethernet (or MAC address-based) profile configuration, one for IPv6 address-based profile configuration, one for IPv4 address-based profile configuration, and one for packet content profile configuration.

The window shown below is the **Add ACL Profile** window for Ethernet:

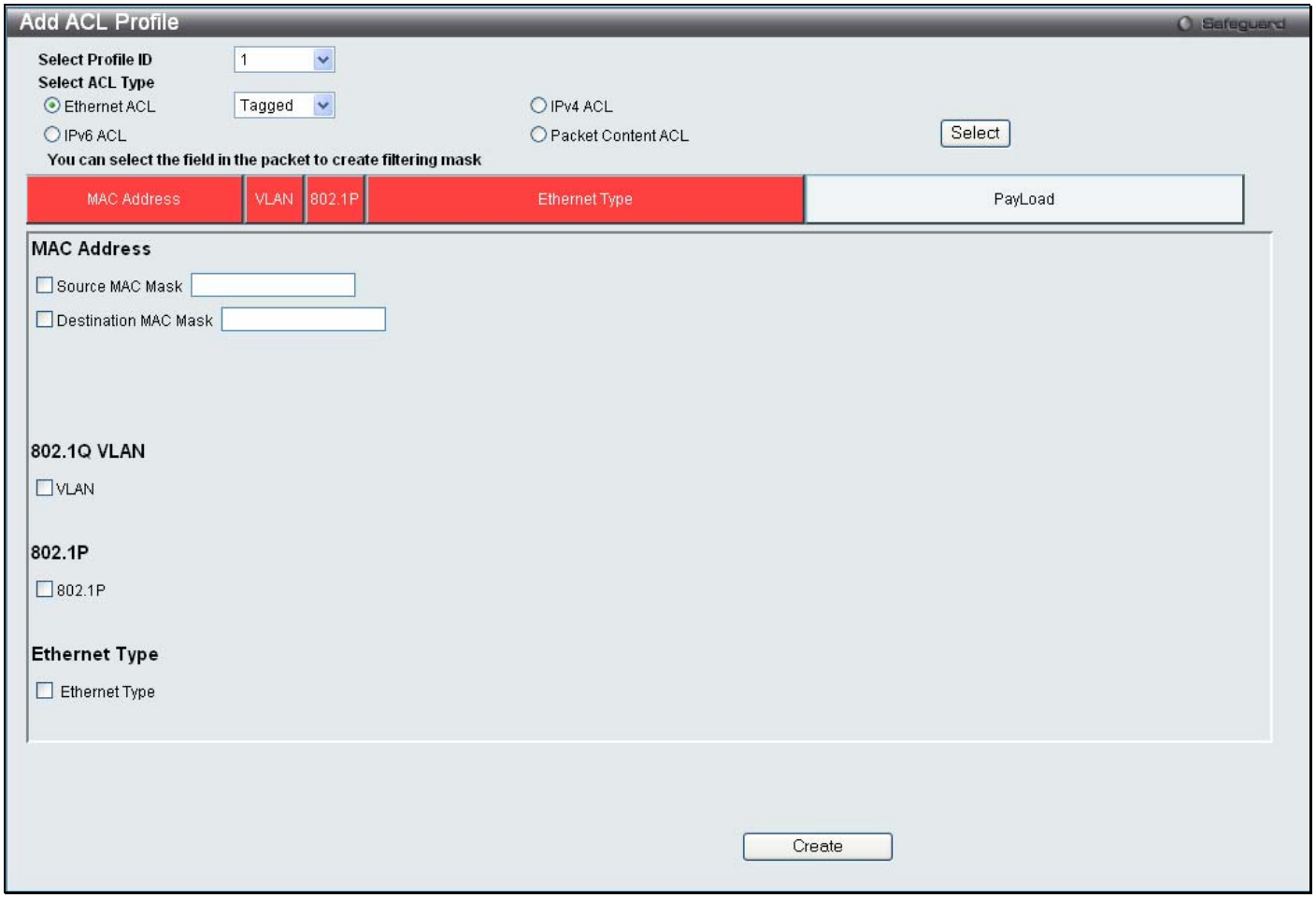


Figure 6 - 2. Add ACL Profile window for Ethernet ACL

The following parameters can be set for the Ethernet ACL type:

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *200*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content. This will change the window according to the requirements for the type of profile. Select Ethernet ACL to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 ACL to instruct the Switch to examine the IPv4 address in each frame's header. Select IPv6 ACL to instruct the Switch to examine the IPv6 address in each frame's header. Select Packet Content to instruct the Switch to examine the packet content in each frame's header.
Source MAC Mask	Enter a MAC address mask for the source MAC address.
Destination MAC Mask	Enter a MAC address mask for the destination MAC address.
802.1Q VLAN	Selecting this option instructs the Switch to examine the 802.1Q VLAN identifier of each packet header and use this as the full or partial criterion for forwarding.
802.1p	Selecting this option instructs the Switch to examine the 802.1p priority value of each packet header and use this as the, or part of the criterion for forwarding.
Ethernet Type	Selecting this option instructs the Switch to examine the Ethernet type value in each frame's header.

Click **Apply** to implement changes made.

To view the setting details for a created profile, click the **Show Details** button for the corresponding entry on the **Access Profile List** window, revealing the following window:

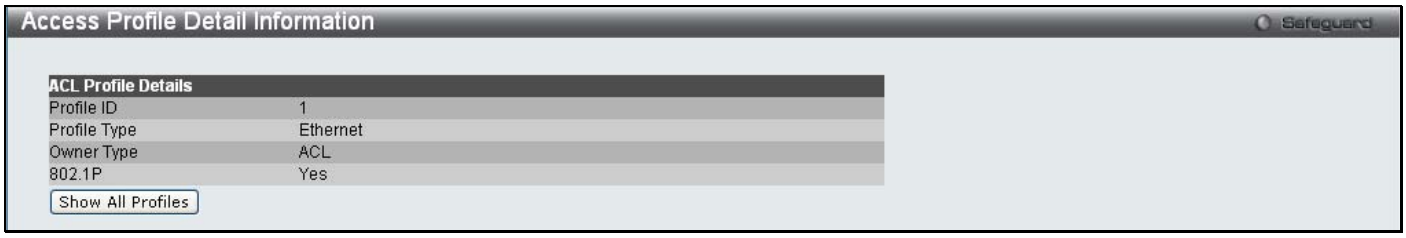


Figure 6 - 3. Access Profile Detail Information window for Ethernet

The window shown below is the **Add ACL Profile** window for IPv4:

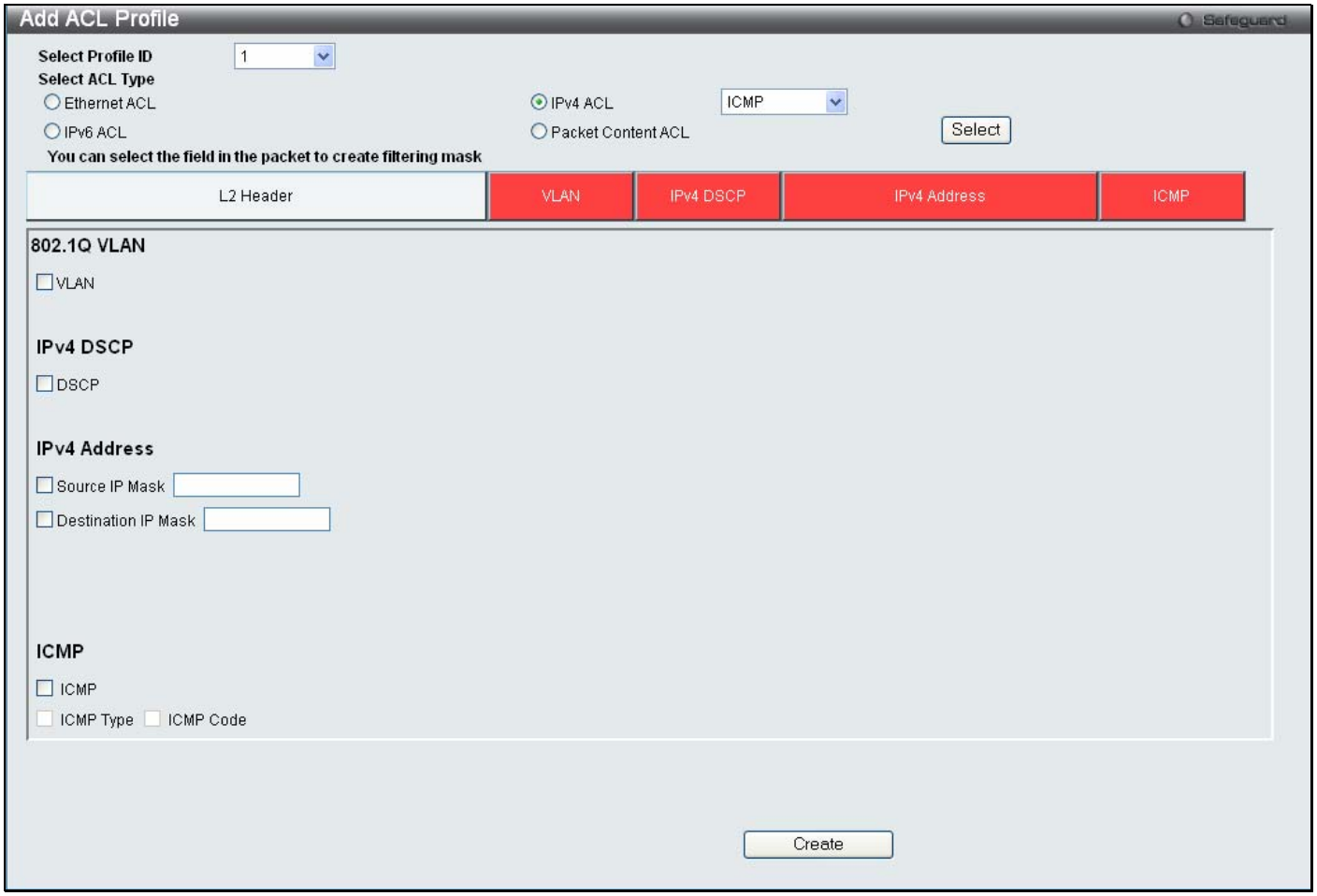


Figure 6 - 4. Add ACL Profile window for IPv4 ACL

The following parameters can be set for the IPv4 ACL type:

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *200*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content. This will change the window according to the requirements for the type of profile. Select Ethernet ACL to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 ACL to instruct the Switch to examine the IPv4 address in each frame's header. Select IPv6 ACL to instruct the Switch to examine the IPv6 address in each frame's header. Select Packet Content to instruct the Switch to examine the packet content in each frame's header.

802.1Q VLAN	Selecting this option instructs the Switch to examine the 802.1Q VLAN identifier of each packet header and use this as the full or partial criterion for forwarding.
IPv4 DSCP	Selecting this option instructs the Switch to examine the DiffServ Code part of each packet header and use this as the, or part of the criterion for forwarding.
IPv4 Source IP Mask	Enter an IP address mask for the source IP address.
IPv4 Destination IP Mask	Enter an IP address mask for the destination IP address.
Protocol	Selecting this option instructs the Switch to examine the protocol type value in each frame's header. Then the user must specify what protocol(s) to include according to the following guidelines: Select *ICMP* to instruct the Switch to examine the Internet Control Message Protocol (ICMP) field in each frame's header. • Select *Type* to further specify that the access profile will apply an ICMP type value, or specify Code to further specify that the access profile will apply an ICMP code value. Select *IGMP* to instruct the Switch to examine the Internet Group Management Protocol (IGMP) field in each frame's header. • Select *Type* to further specify that the access profile will apply an IGMP type value. Select *TCP* to use the TCP port number contained in an incoming packet as the forwarding criterion. Selecting TCP requires that you specify a source port mask and/or a destination port mask. • *src port mask* - Specify a TCP port mask for the source port in hex form (hex 0x0-0xffff), which you wish to filter. • *dst port mask* - Specify a TCP port mask for the destination port in hex form (hex 0x0-0xffff) which you wish to filter. • *flag bit* - The user may also identify which flag bits to filter. Flag bits are parts of a packet that determine what to do with the packet. The user may filter packets by filtering certain flag bits within the packets, by checking the boxes corresponding to the flag bits of the TCP field. The user may choose between urg (urgent), ack (acknowledgement), psh (push), rst (reset), syn (synchronize), fin (finish). Select *UDP* to use the UDP port number contained in an incoming packet as the forwarding criterion. Selecting UDP requires that you specify a source port mask and/or a destination port mask. • *src port mask* - Specify a UDP port mask for the source port in hex form (hex 0x0-0xffff). • *dst port mask* - Specify a UDP port mask for the destination port in hex form (hex 0x0-0xffff). *protocol id* - Enter a value defining the protocol ID in the packet header to mask. Specify the protocol ID mask in hex form (hex 0x0-0xff).

Click **Apply** to implement changes made.

To view the setting details for a created profile, click the **Show Details** button for the corresponding entry on the **Access Profile List** window, revealing the following window:

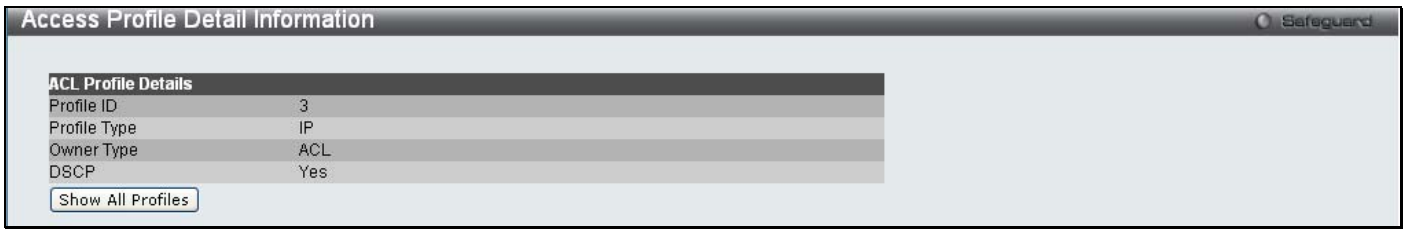


Figure 6 - 5. Access Profile Detail Information window for IPv4

The window shown below is the **Add ACL Profile** window for IPv6:

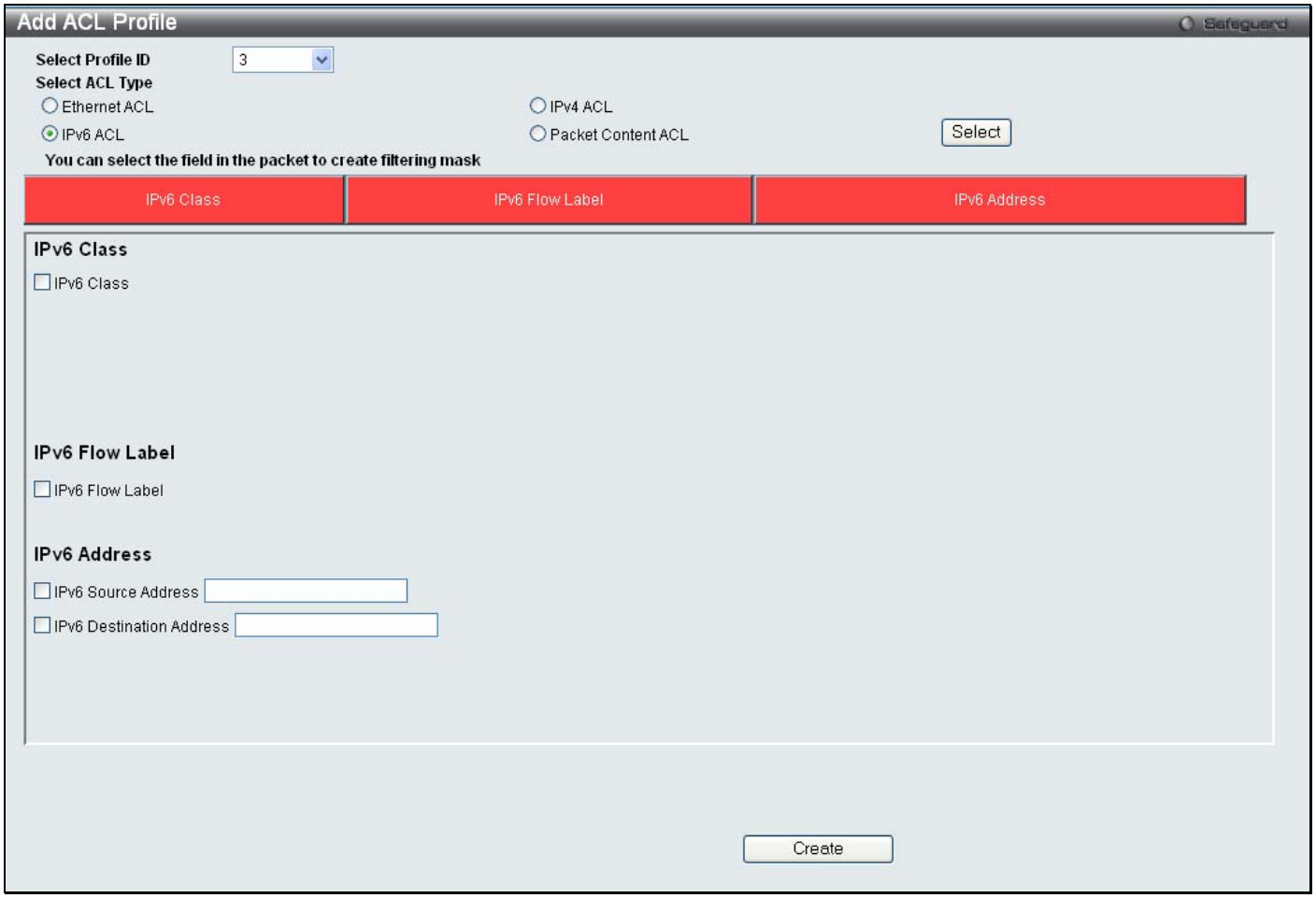


Figure 6 - 6. Add ACL Profile window for IPv6

The following parameters can be set for the IPv6 ACL type:

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *200*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content. This will change the window according to the requirements for the type of profile. Select Ethernet ACL to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 ACL to instruct the Switch to examine the IPv4 address in each frame's header. Select IPv6 ACL to instruct the Switch to examine the IPv6 address in each frame's header. Select Packet Content to instruct the Switch to examine the packet content in each frame's header.
IPv6 Class	Ticking this check box will instruct the Switch to examine the *class* field of the IPv6 header. This class field is a part of the packet header that is similar to the Type of Service (ToS) or Precedence bits field in IPv4.
IPv6 Flow Label	Ticking this check box will instruct the Switch to examine the *flow label* field of the IPv6 header. This flow label field is used by a source to label sequences of packets such as non-default quality of service or real time service packets.
IPv6 Source Address	The user may specify an IP address mask for the source IPv6 address by ticking the corresponding check box and entering the IP address mask.
IPv6 Destination Address	The user may specify an IP address mask for the destination IPv6 address by ticking the corresponding check box and entering the IP address mask.

Click **Apply** to implement changes made.

To view the setting details for a created profile, click the **Show Details** button for the corresponding entry on the **Access Profile List** window, revealing the following window:

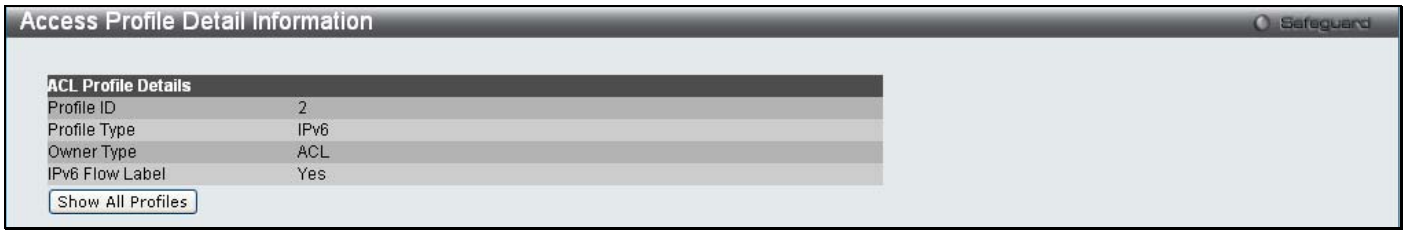


Figure 6 - 7. Access Profile Detail Information window for IPv6

The window shown below is the **Add ACL Profile** window for Packet Content:

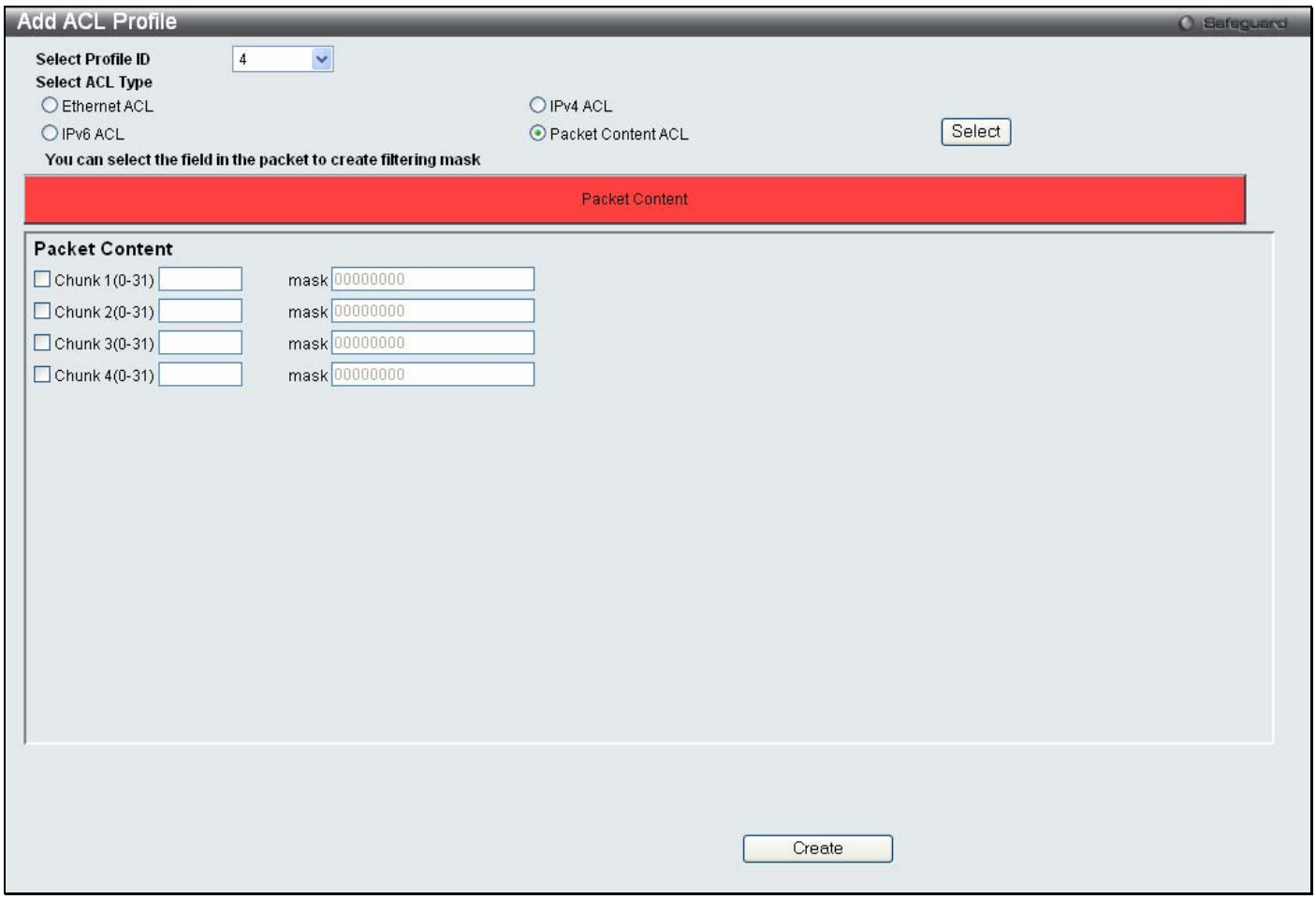


Figure 6 - 8. Add ACL Profile window for Packet Content

The following parameters can be set for the Packet Content type:

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *200*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content. This will change the window according to the requirements for the type of profile. Select Ethernet ACL to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 ACL to instruct the Switch to examine the IPv4 address in each frame's header. Select IPv6 ACL to instruct the Switch to examine the IPv6 address in each frame's header. Select Packet Content to instruct the Switch to examine the packet content in each frame's header.

<table>
<tr>
<td>Packet Content</td>
<td>Allows users to examine up to four specified offset chunks within a packet, one at a time. A chunk mask presents four bytes. Four offset chunks can be selected from a possible 32 predefined offset chunks as described below:
offset_chunk_1,
offset_chunk_2,
offset_chunk_3,
offset_chunk_4.
<table>
<tr><th>chunk0</th><th>chunk1</th><th>chunk2</th><th>……</th><th>chunk29</th><th>chunk30</th><th>chunk31</th></tr>
<tr><td>B126,
B127,
B0,
B1</td><td>B2,
B3,
B4,
B5</td><td>B6,
B7,
B8,
B9</td><td>……</td><td>B114,
B115,
B116,
B117</td><td>B118,
B119,
B120,
B121</td><td>B122,
B123,
B124,
B125</td></tr>
</table>
Example:
offset_chunk_1 0 0xffffffff will match packet byte offset 126, 127, 0, 1

offset_chunk_1 0 0x0000ffff will match packet byte offset, 0,1
Note:
Only one packet content mask profile can be created at a time. Use of the D-Link xStack switch family's advanced Packet Content Mask (also known as Packet Content Access Control List – ACL) feature can effectively mitigate common network attacks such as ARP Spoofing. The Switch's implementation of Packet Content ACL enables inspection of any packet's specified content regardless of the protocol layer.</td>
</tr>
</table>

Click **Apply** to implement changes made.

To view the setting details for a created profile, click the **Show Details** button for the corresponding entry on the **Access Profile List** window, revealing the following window:

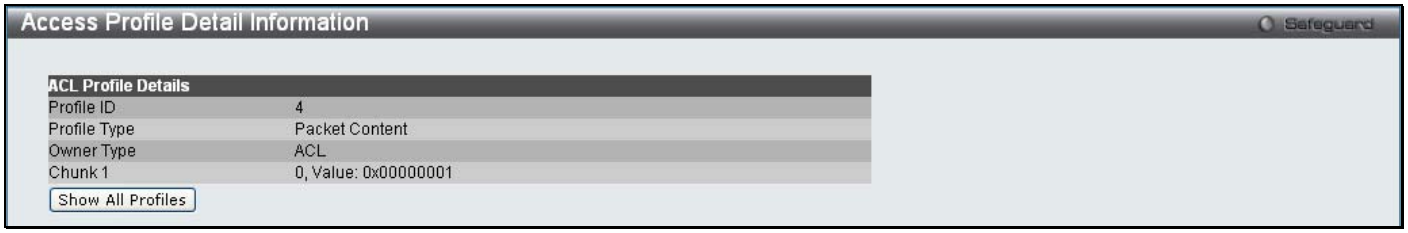


Figure 6 - 9. Access Profile Detail Information window for Packet Content

NOTE: Address Resolution Protocol (ARP) is the standard for finding a host's hardware address (MAC address). However, ARP is vulnerable as it can be easily spoofed and utilized to attack a LAN (i.e. an ARP spoofing attack). For a more detailed explanation on how ARP protocol works and how to employ D-Link's unique Packet Content ACL to prevent ARP spoofing attack, please see Appendix E at the end of this manual.

To establish the rule for a previously created Access Profile:

To configure the Access Rules for Ethernet, open the **Access Profile List** window and click **Add/View Rules** for an Ethernet entry. This will open the following window:

Figure 6 - 10. Access Rule List window for Ethernet

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

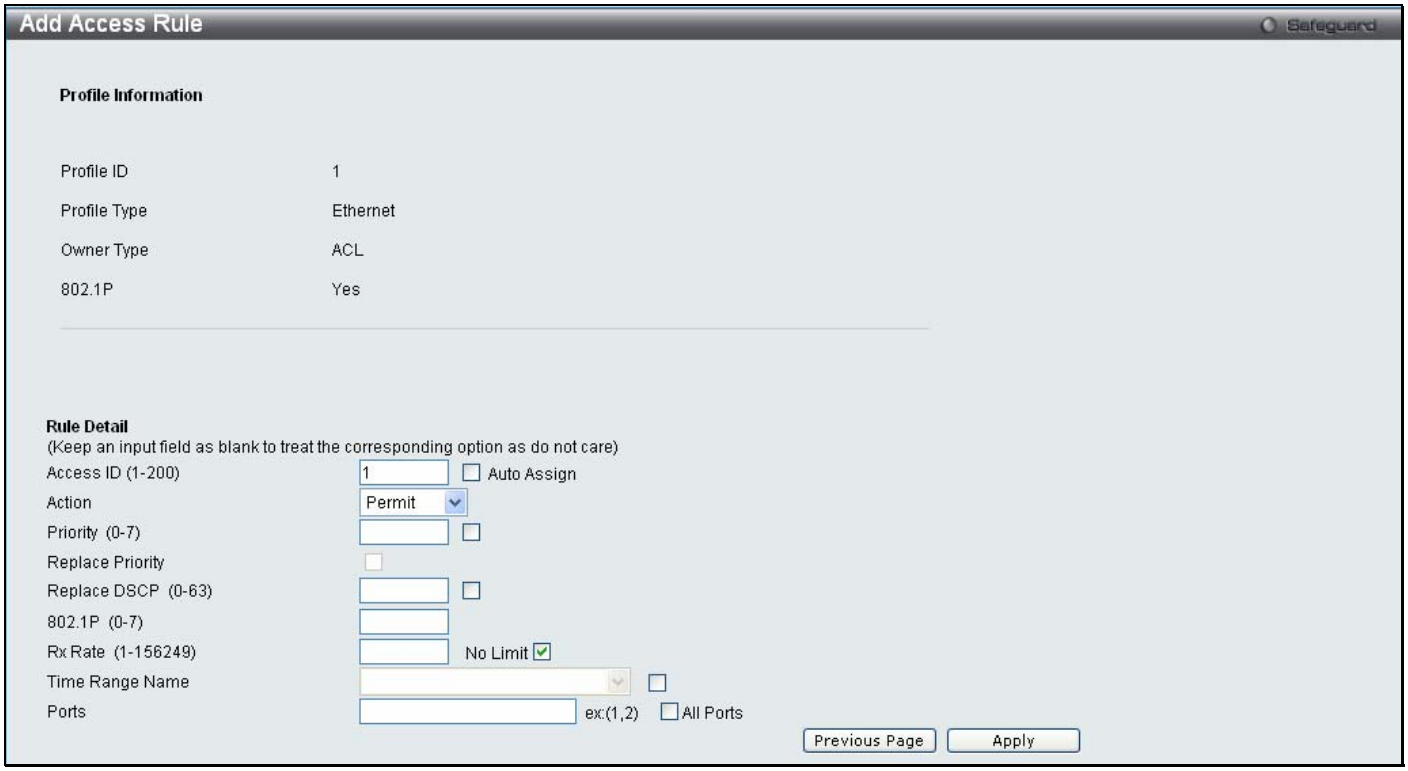


Figure 6 - 11. Add Access Rule window for Ethernet

To set the Access Rule for Ethernet, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-200)	Type in a unique identifier number for this access. This value can be set from *1* to *200*. Auto Assign – Ticking this check box will instruct the Switch to automatically assign an Access ID for the rule being created.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered. Select *Mirror* to specify that packets that match the access profile are mirrored to a port defined in the config mirror port command. Port Mirroring must be enabled and a target port must be set.
Priority (0-7)	Tick the corresponding check box if you want to re-write the 802.1p default priority of a packet to the value entered in the Priority field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the QoS section of this manual.
Replace Priority	Tick this check box to replace the Priority value in the adjacent field.

Replace DSCP (0-63)	Select this option to instruct the Switch to replace the DSCP value (in a packet that meets the selected criteria) with the value entered in the adjacent field. **When an ACL rule is added to change both the priority and DSCP of an IPv4 packet, only one of them can be modified due to a chip limitation. Currently the priority is changed when both the priority and DSCP are set to be modified.**
VLAN Name	Allows the entry of a name for a previously configured VLAN.
802.1p (0-7)	Enter a value from *0* to *7* to specify that the access profile will apply only to packets with this 802.1p priority value.
Ethernet Type (0-FFFF)	Selected profile based on Ethernet (MAC Address), IP address or IPv6 address *Ethernet* instructs the Switch to examine the layer 2 part of each packet header. *IP* instructs the Switch to examine the IP address in each frame's header. *IPv6* instructs the Switch to examine the IPv6 address in each frame's header.
Rx Rate (1-156249)	Use this to limit Rx bandwidth for the profile being configured. This rate is implemented using the following equation: 1 value = 64kbit/sec. (ex. If the user selects an Rx rate of *10* then the ingress rate is 640kbit/sec.) The user many select a value between *1* and *156249* or tick the No Limit check box. The default setting is No Limit.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	When a range of ports is to be configured, the Auto Assign check box MUST be ticked in the Access ID field of this window. If not, the user will be presented with an error message and the access rule will not be configured. Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **Access Rule List** window to view the following window:

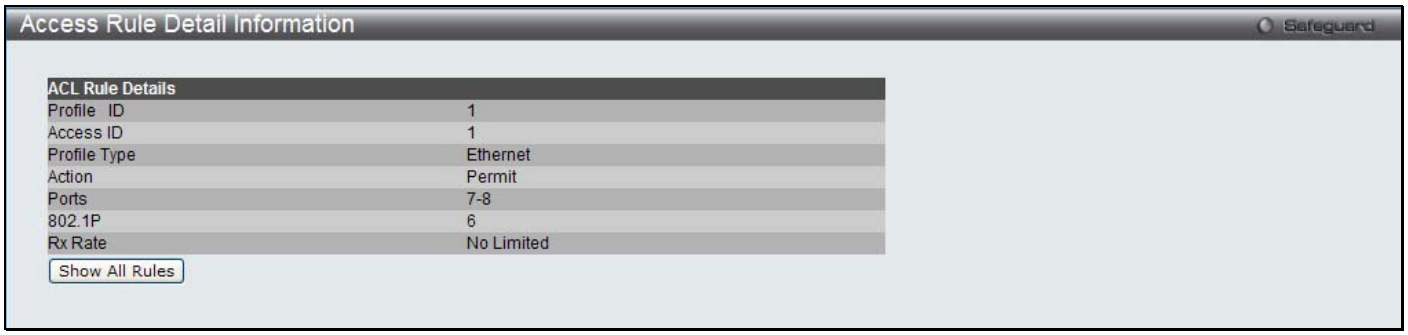


Figure 6 - 12. Access Rule Detail Information window for Ethernet

To establish the rule for a previously created Access Profile:

To configure the Access Rules for IPv4, open the **Access Profile List** window and click **Add/View Rules** for an IPv4 entry. This will open the following window:

Figure 6 - 13. Access Rule List window for IPv4

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

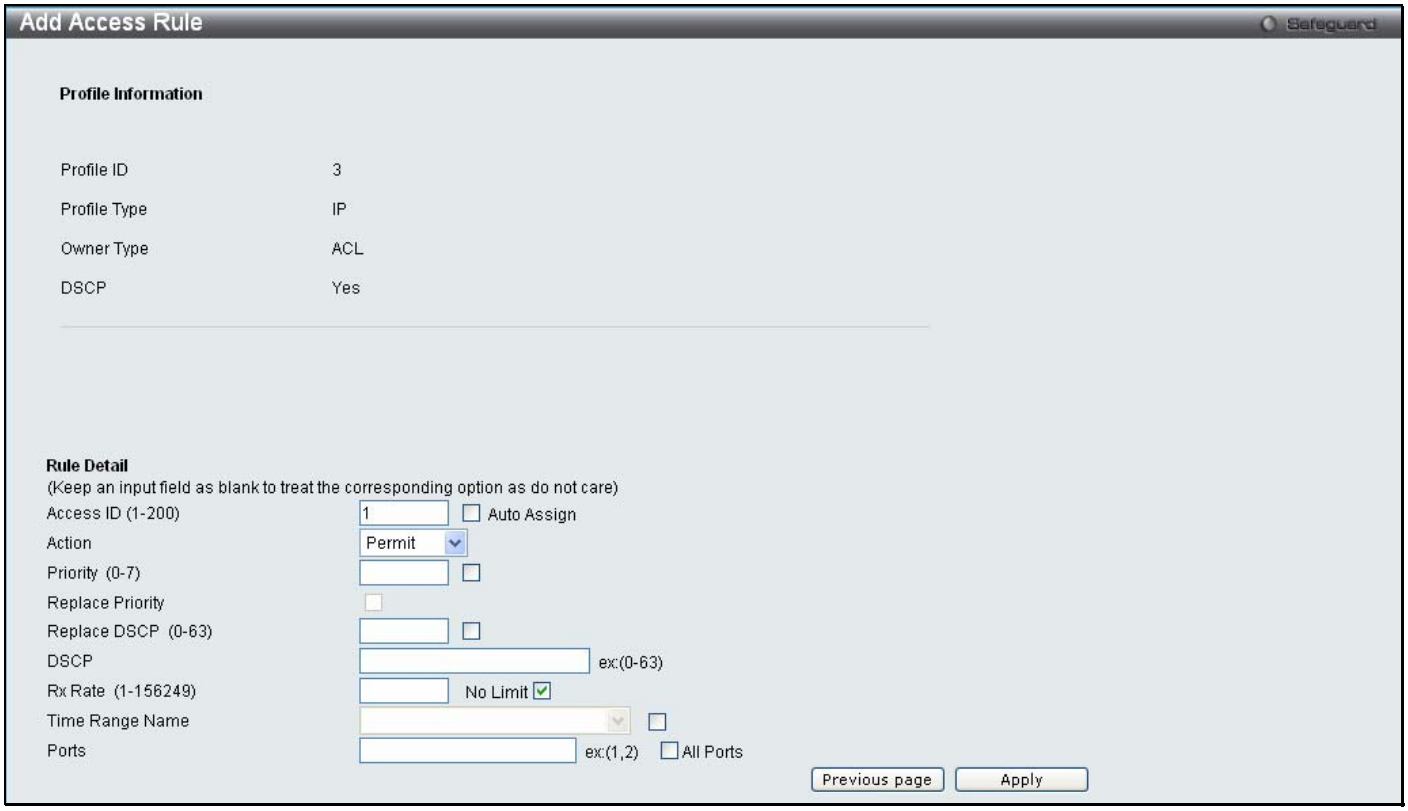


Figure 6 - 14. Add Access Rule window for IPv4

To set the Access Rule for IP, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-200)	Type in a unique identifier number for this access. This value can be set from *1* to *200*. Auto Assign – Ticking this check box will instruct the Switch to automatically assign an Access ID for the rule being created.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered. Select *Mirror* to specify that packets that match the access profile are mirrored to a port defined in the config mirror port command. Port Mirroring must be enabled and a target port must be set.
Priority (0-7)	Tick the corresponding check box if you want to re-write the 802.1p default priority of a packet to the value entered in the Priority field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the QoS section of this manual.
Replace Priority	Tick this check box to replace the Priority value in the adjacent field.
Replace DSCP (0-63)	Select this option to instruct the Switch to replace the DSCP value (in a packet that meets the selected criteria) with the value entered in the adjacent field. **When an ACL rule is added to change both the priority and DSCP of an IPv4 packet, only one of them can be modified due to a chip limitation. Currently the priority is changed when both the priority and DSCP are set to be modified.**
DSCP	This field allows the user to enter a DSCP value in the space provided, which will instruct the Switch to examine the DiffServ Code part of each packet header and use this as the, or part of the criterion for forwarding. The user may choose a value between *0* and *63*.
Rx Rate (1-156249)	Use this to limit Rx bandwidth for the profile being configured. This rate is implemented using the following equation: 1 value = 64kbit/sec. (ex. If the user selects an Rx rate of *10* then the ingress rate is 640kbit/sec.) The user many select a value between *1* and *156249* or tick the No Limit

	check box. The default setting is No Limit.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	When a range of ports is to be configured, the Auto Assign check box MUST be ticked in the Access ID field of this window. If not, the user will be presented with an error message and the access rule will not be configured. Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **Access Rule List** window to view the following window:

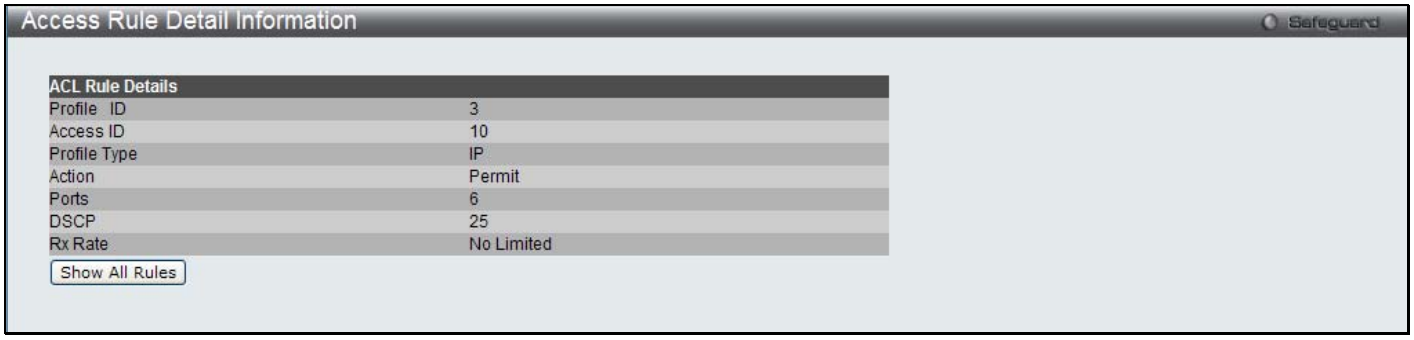


Figure 6 - 15. Access Rule Detail Information window for IPv4

To establish the rule for a previously created Access Profile:

To configure the Access Rules for Ethernet, open the **Access Profile List** window and click **Add/View Rules** for an IPv6 entry. This will open the following window:

Figure 6 - 16. Access Rule List window for IPv6

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

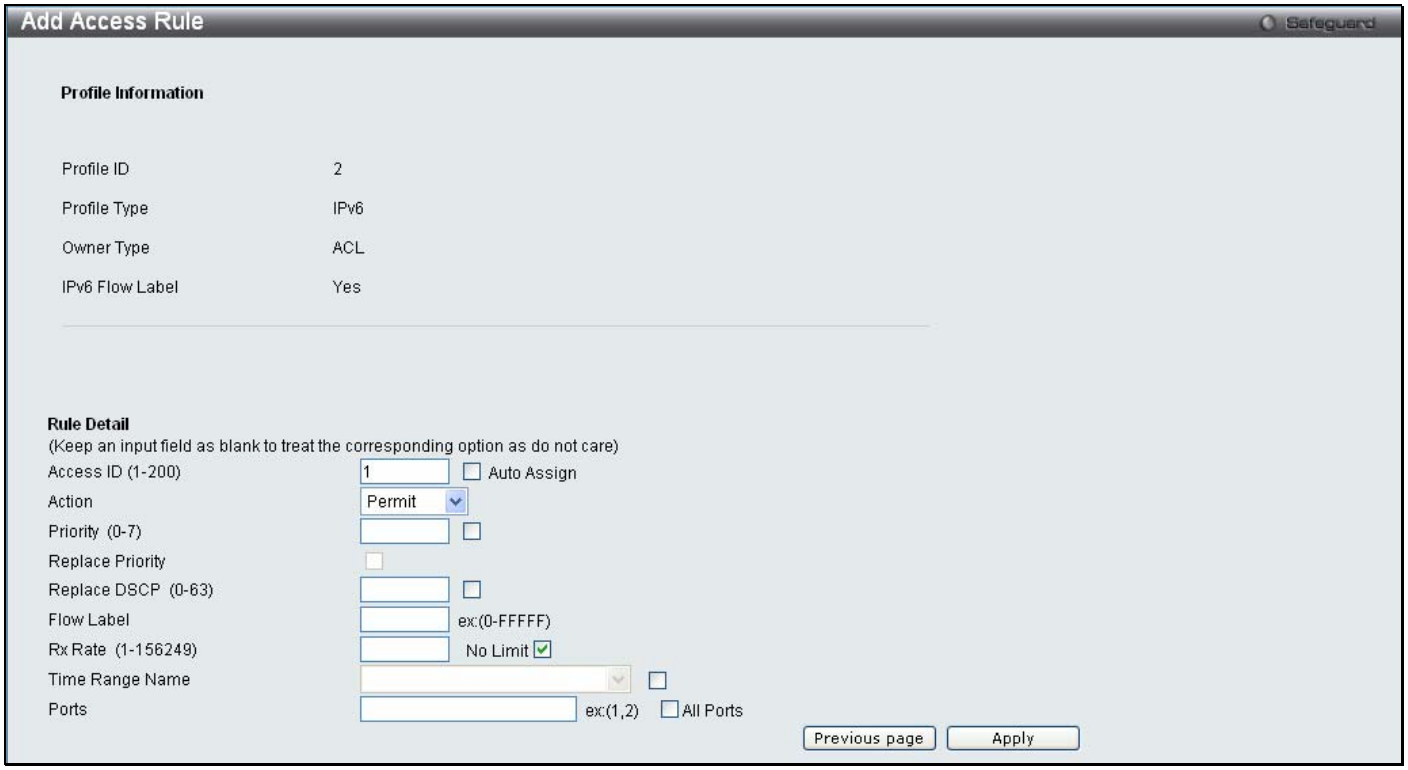


Figure 6 - 17. Add Access Rule window for IPv6

To set the Access Rule for IPv6, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-200)	Type in a unique identifier number for this access. This value can be set from *1* to *200*. Auto Assign – Ticking this check box will instruct the Switch to automatically assign an Access ID for the rule being created.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that match the access profile are not forwarded by the Switch and will be filtered. Select *Mirror* to specify that packets that match the access profile are mirrored to a port defined in the config mirror port command. Port Mirroring must be enabled and a target port must be set.
Priority (0-7)	Tick the corresponding check box to re-write the 802.1p default priority of a packet to the value entered in the Priority field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the QoS section of this manual.
Replace Priority	Tick this check box to replace the Priority value in the adjacent field.
Replace DSCP (0-63)	Select this option to instruct the Switch to replace the DSCP value (in a packet that meets the selected criteria) with the value entered in the adjacent field. **When an ACL rule is added to change both the priority and DSCP of an IPv6 packet, only one of them can be modified due to a chip limitation. Currently the priority is changed when both the priority and DSCP are set to be modified.**
Flow Label	Configuring this field, in hex form, will instruct the Switch to examine the flow label field of the IPv6 header. This flow label field is used by a source to label sequences of packets such as non-default quality of service or real time service packets.
Rx Rate (1-156249)	Use this to limit Rx bandwidth for the profile being configured. This rate is implemented using the following equation: 1 value = 64kbit/sec. (ex. If the user selects an Rx rate of *10* then the ingress

	rate is 640kbit/sec.) The user many select a value between *1* and *156249* or tick the No Limit check box. The default setting is No Limit.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	When a range of ports is to be configured, the Auto Assign check box MUST be ticked in the Access ID field of this window. If not, the user will be presented with an error message and the access rule will not be configured. Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **Access Rule List** window to view the following window:

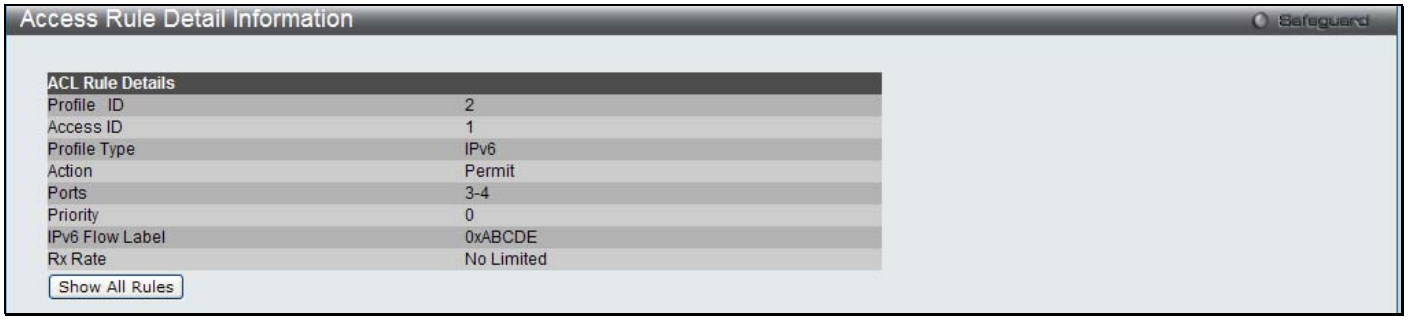


Figure 6 - 18. Access Rule Detail Information window for IPv6

To establish the rule for a previously created Access Profile:

To configure the Access Rules for IPv4, open the **Access Profile List** window and click **Add/View Rules** for an IPv4 entry. This will open the following window:

Figure 6 - 19. Access Rule List window for Packet Content

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

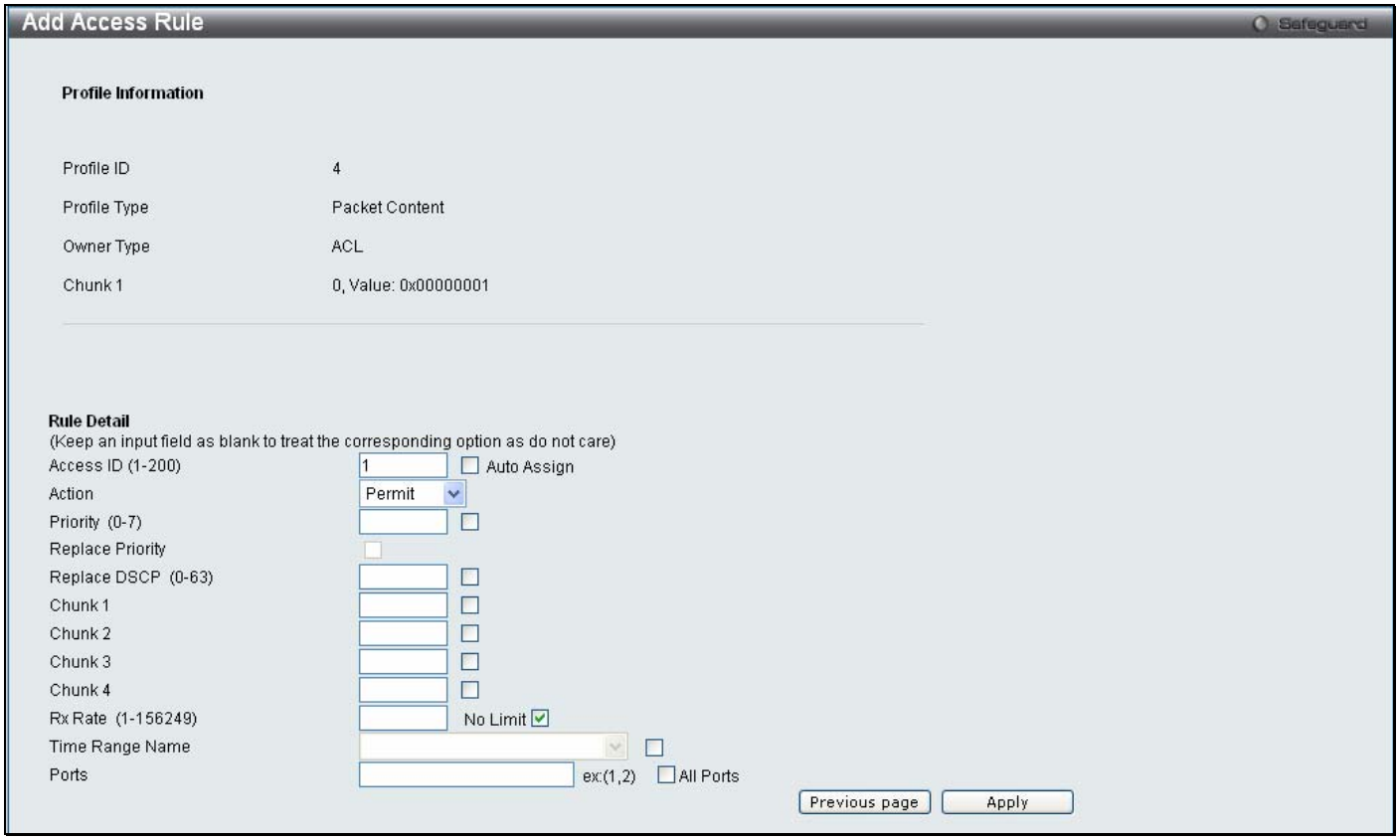


Figure 6 - 20. Add Access Rule window for Packet Content

To set the Access Rule for Packet Content, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-200)	Type in a unique identifier number for this access. This value can be set from *1* to *200*. Auto Assign – Ticking this check box will instruct the Switch to automatically assign an Access ID for the rule being created.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered. Select *Mirror* to specify that packets that match the access profile are mirrored to a port defined in the config mirror port command. Port Mirroring must be enabled and a target port must be set.
Priority (0-7)	Tick the corresponding check box if you want to re-write the 802.1p default priority of a packet to the value entered in the Priority field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the QoS section of this manual.
Replace Priority	Tick this check box to replace the Priority value in the adjacent field.
Replace DSCP (0-63)	Select this option to instruct the Switch to replace the DSCP value (in a packet that meets the selected criteria) with the value entered in the adjacent field. **When an ACL rule is added to change both the priority and DSCP of an IPv4 packet, only one of them can be modified due to a chip limitation. Currently the priority is changed when both the priority and DSCP are set to be modified.**
Chunk	This field will instruct the Switch to mask the packet header beginning with the offset value specified.
Rx Rate (1-	Use this to limit Rx bandwidth for the profile being configured. This rate is implemented using the following equation: 1 value = 64kbit/sec. (ex. If the user selects an Rx rate of *10* then the ingress

156249)	rate is 640kbit/sec.) The user many select a value between *1* and *156249* or tick the No Limit check box. The default setting is No Limit.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	When a range of ports is to be configured, the Auto Assign check box MUST be ticked in the Access ID field of this window. If not, the user will be presented with an error message and the access rule will not be configured. Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **Access Rule List** window to view the following window:

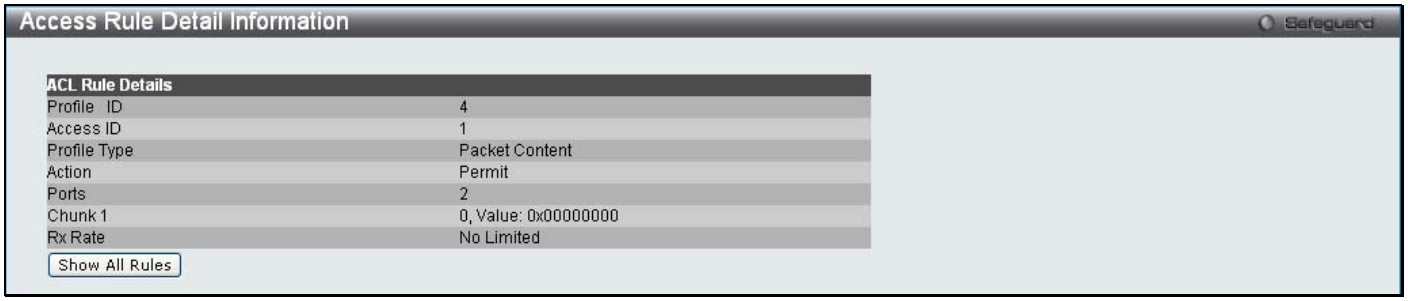


Figure 6 - 21. Access Rule Detail Information window for Packet Content

CPU Access Profile List

Due to a chipset limitation and needed extra switch security, the Switch incorporates CPU Interface filtering. This added feature increases the running security of the Switch by enabling the user to create a list of access rules for packets destined for the Switch's CPU interface. Employed similarly to the Access Profile feature previously mentioned, CPU interface filtering examines Ethernet, IP and Packet Content Mask packet headers destined for the CPU and will either forward them or filter them, based on the user's implementation. As an added feature for the CPU Filtering, the Switch allows the CPU filtering mechanism to be enabled or disabled globally, permitting the user to create various lists of rules without immediately enabling them.

Creating an access profile for the CPU is divided into two basic parts. The first is to specify which part or parts of a frame the Switch will examine, such as the MAC source address or the IP destination address. The second part is entering the criteria the Switch will use to determine what to do with the frame. The entire process is described below.

Users may globally enable or disable the CPU Interface Filtering State mechanism by using the radio buttons to change the running state. Choose Enabled to enable CPU packets to be scrutinized by the Switch and Disabled to disallow this scrutiny.

To view the following window, click **ACL > CPU Access Profile List**:

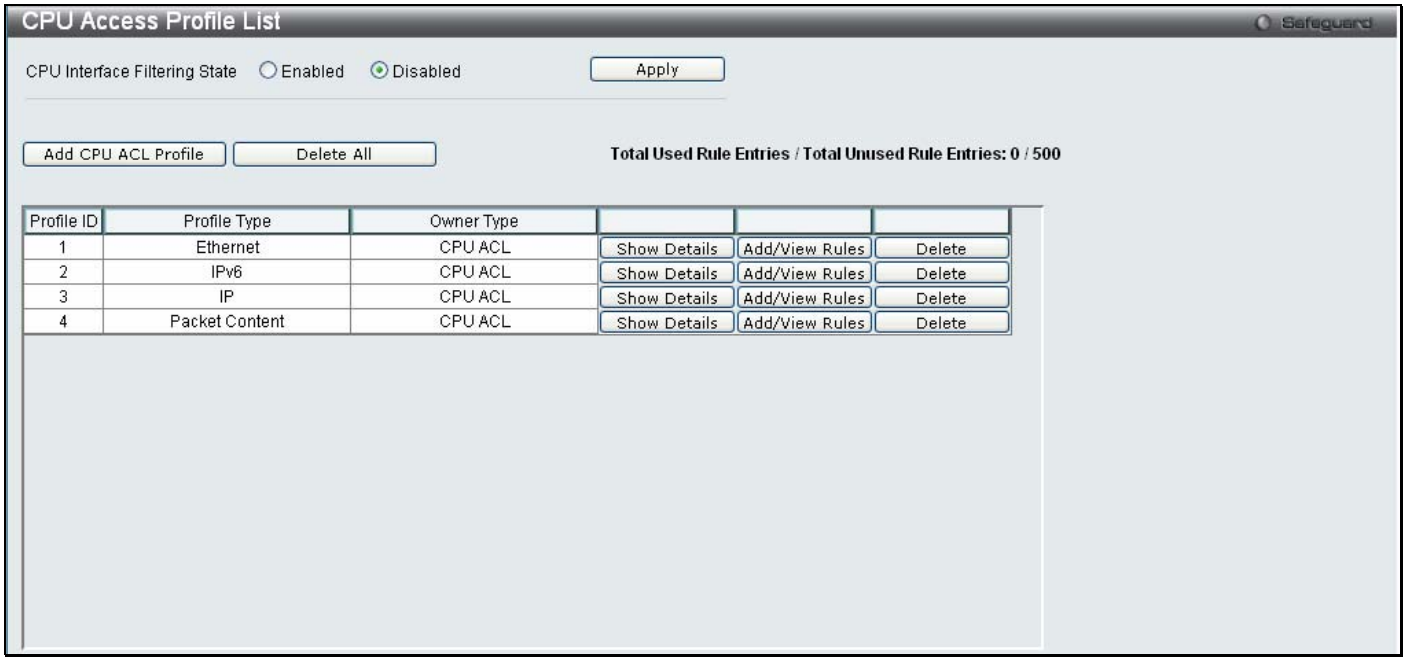


Figure 6 - 22. CPU Access Profile List window

This window displays the CPU Access Profile List entries created on the Switch (one CPU access profile of each type has been created for explanatory purposes). To view the configurations for an entry, click the corresponding **Show Details** button.

To add an entry to the CPU Acces Profile List, click the **Add ACL Profile** button. This will open the **Add CPU ACL Profile** window, as shown below. To remove all CPU Access Profile List entries, click the **Delete All** button.

The Switch supports four CPU Access Profile types: Ethernet (or MAC address-based) profile configuration, IP (IPv4) address-based profile configuration, IPv6 address-based profile configuration, and Packet Content Mask.

The window shown below is the **Add CPU ACL Profile** window for Ethernet.

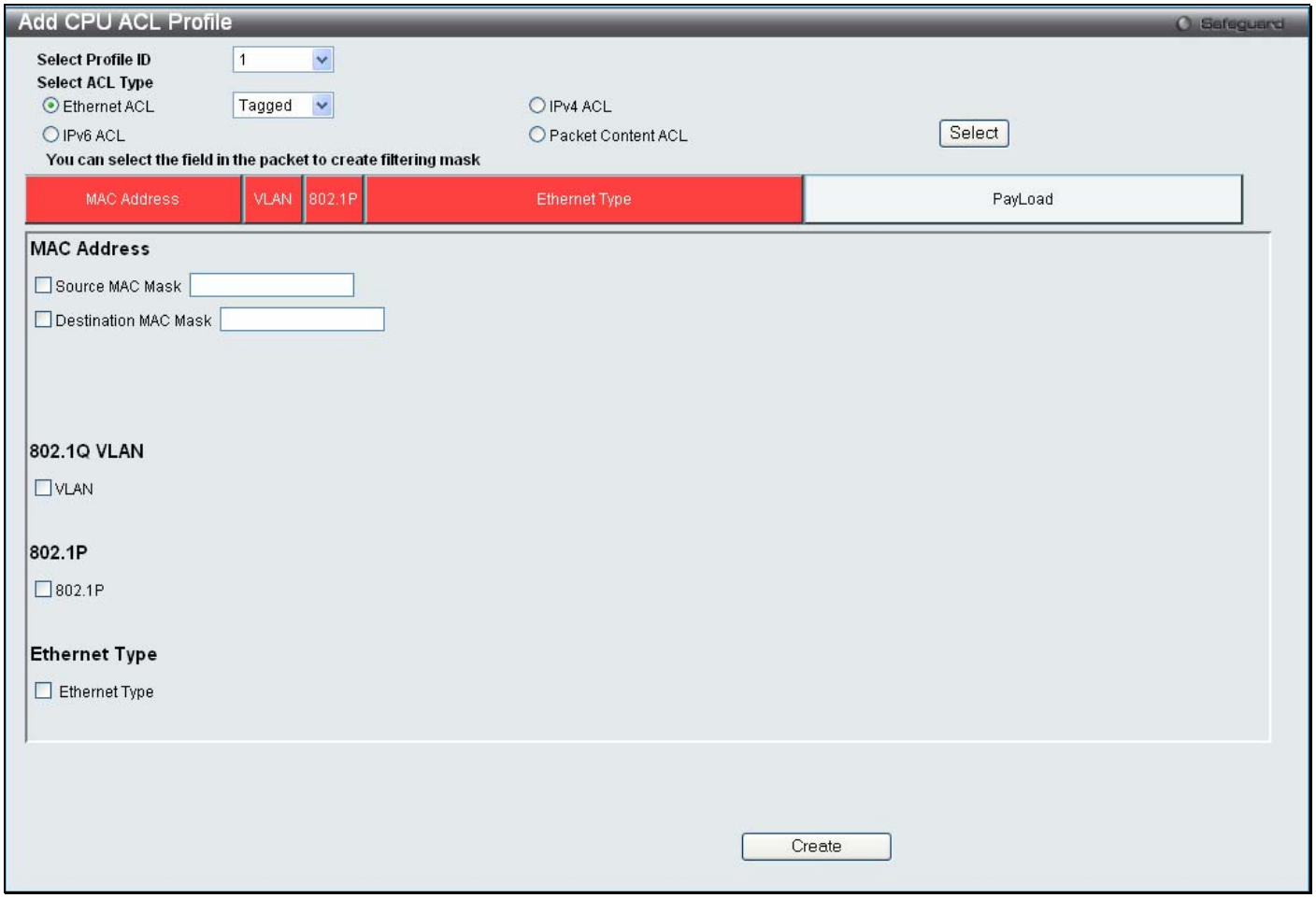


Figure 6 - 23. Add CPU ACL Profile window for Ethernet

Parameter	Description
Select Profile ID (1-5)	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *5*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content mask. This will change the window according to the requirements for the type of profile. Select Ethernet to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 to instruct the Switch to examine the IP address in each frame's header. Select IPv6 to instruct the Switch to examine the IP address in each frame's header. Select Packet Content Mask to specify a mask to hide the content of the packet header.
Source MAC Mask	Enter a MAC address mask for the source MAC address.
Destination MAC Mask	Enter a MAC address mask for the destination MAC address.
802.1Q VLAN	Selecting this option instructs the Switch to examine the VLAN identifier of each packet header and use this as the full or partial criterion for forwarding.
802.1p	Selecting this option instructs the Switch to specify that the access profile will apply only to packets with this 802.1p priority value.
Ethernet Type	Selecting this option instructs the Switch to examine the Ethernet type value in each frame's header.

Click **Apply** to set this entry in the Switch's memory.

To view the settings of a previously correctly created profile, click the corresponding **Show Details** button on the **CPU Access Profile List** window to view the following window:

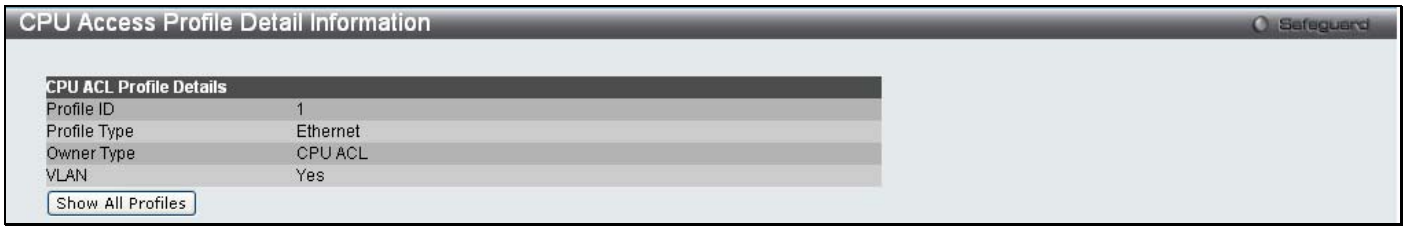


Figure 6 - 24. CPU Access Profile Detail Information window for Ethernet

The window shown below is the **Add CPU ACL Profile** window for IP (IPv4).

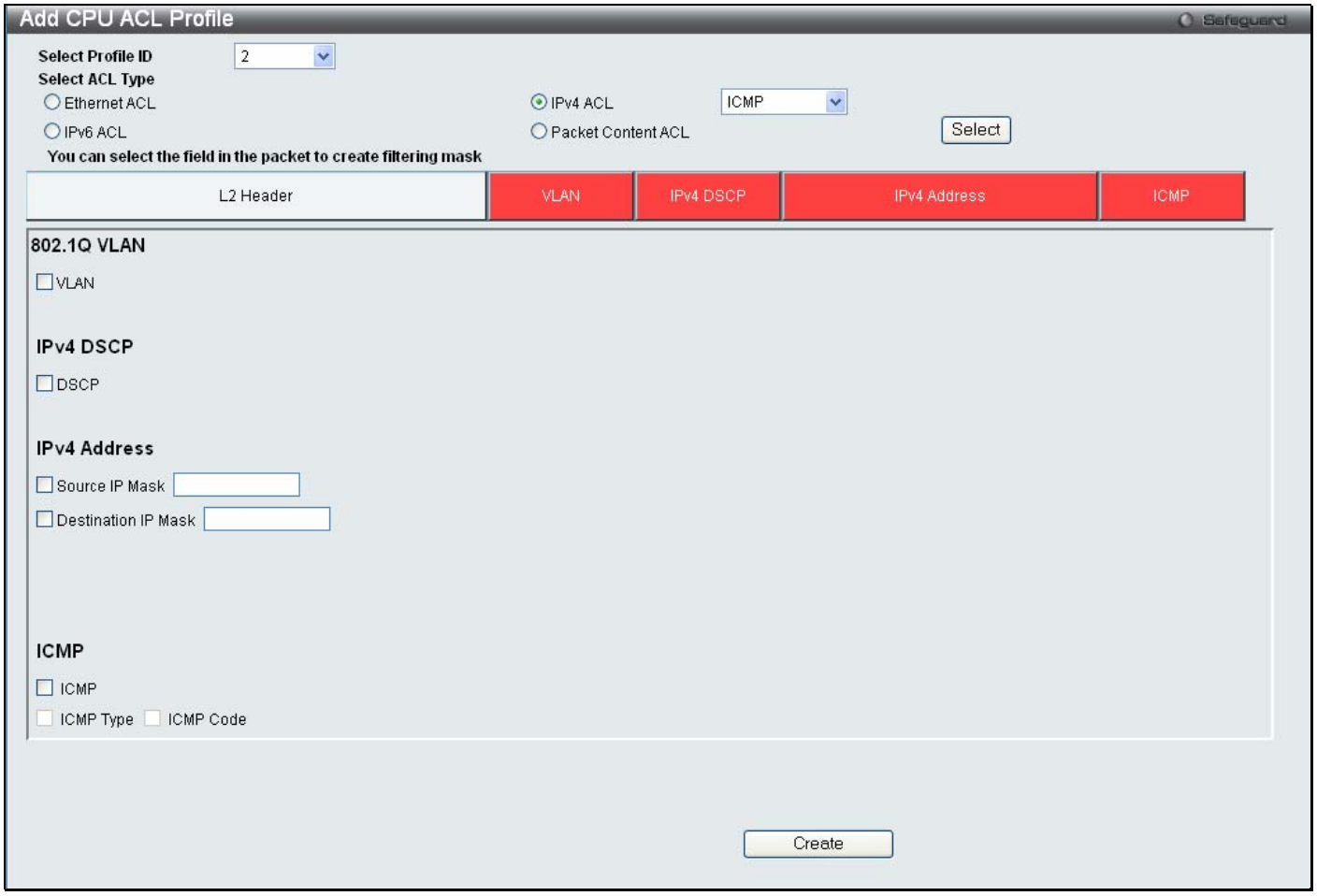


Figure 6 - 25. Add CPU ACL Profile window for IP (IPv4)

The following parameters may be configured for the IP (IPv4) filter.

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *5*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content mask. This will change the menu according to the requirements for the type of profile. Select Ethernet to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 to instruct the Switch to examine the IP address in each frame's header. Select IPv6 to instruct the Switch to examine the IP address in each frame's header. Select Packet Content Mask to specify a mask to hide the content of the packet header.
802.1Q VLAN	Selecting this option instructs the Switch to examine the VLAN part of each packet header

	and use this as the, or part of the criterion for forwarding.
IPv4 DSCP	Selecting this option instructs the Switch to examine the DiffServ Code part of each packet header and use this as the, or part of the criterion for forwarding.
Source IP Mask	Enter an IP address mask for the source IP address.
Destination IP Mask	Enter an IP address mask for the destination IP address.
Protocol	Selecting this option instructs the Switch to examine the protocol type value in each frame's header. You must then specify what protocol(s) to include according to the following guidelines: Select *ICMP* to instruct the Switch to examine the Internet Control Message Protocol (ICMP) field in each frame's header. • Select *Type* to further specify that the access profile will apply an ICMP type value, or specify *Code* to further specify that the access profile will apply an ICMP code value. Select *IGMP* to instruct the Switch to examine the Internet Group Management Protocol (IGMP) field in each frame's header. • Select *Type* to further specify that the access profile will apply an IGMP type value. Select *TCP* to use the TCP port number contained in an incoming packet as the forwarding criterion. Selecting TCP requires a source port mask and/or a destination port mask is to be specified. The user may also identify which flag bits to filter. Flag bits are parts of a packet that determine what to do with the packet. The user may filter packets by filtering certain flag bits within the packets, by checking the boxes corresponding to the flag bits of the TCP field. The user may choose between urg (urgent), ack (acknowledgement), psh (push), rst (reset), syn (synchronize), fin (finish). • *src port mask* - Specify a TCP port mask for the source port in hex form (hex 0x0-0xffff), which you wish to filter. • *dst port mask* - Specify a TCP port mask for the destination port in hex form (hex 0x0-0xffff) which you wish to filter. Select *UDP* to use the UDP port number contained in an incoming packet as the forwarding criterion. Selecting UDP requires that you specify a source port mask and/or a destination port mask. • *src port mask* - Specify a UDP port mask for the source port in hex form (hex 0x0-0xffff). • *dst port mask* - Specify a UDP port mask for the destination port in hex form (hex 0x0-0xffff). *Protocol id* - Enter a value defining the protocol ID in the packet header to mask. Specify the protocol ID mask in hex form (hex 0x0-0xff). Use the following command on the CLI: "DGS-3200-10:4#create access_profile profile_id 1 ip protocol_id_mask 0xFF user_define_mask <hex 0x0-0xffffffff>".

Click **Apply** to set this entry in the Switch's memory.

To view the settings of a previously correctly created profile, click the corresponding **Show Details** button on the **CPU Access Profile List** window to view the following window:

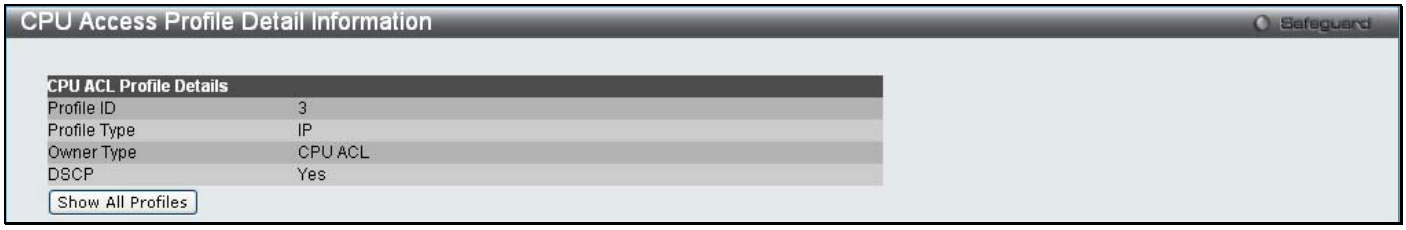


Figure 6 - 26. CPU Access Profile Detail Information window for IP (IPv4)

The window shown below is the **Add CPU ACL Profile** window for IPv6.

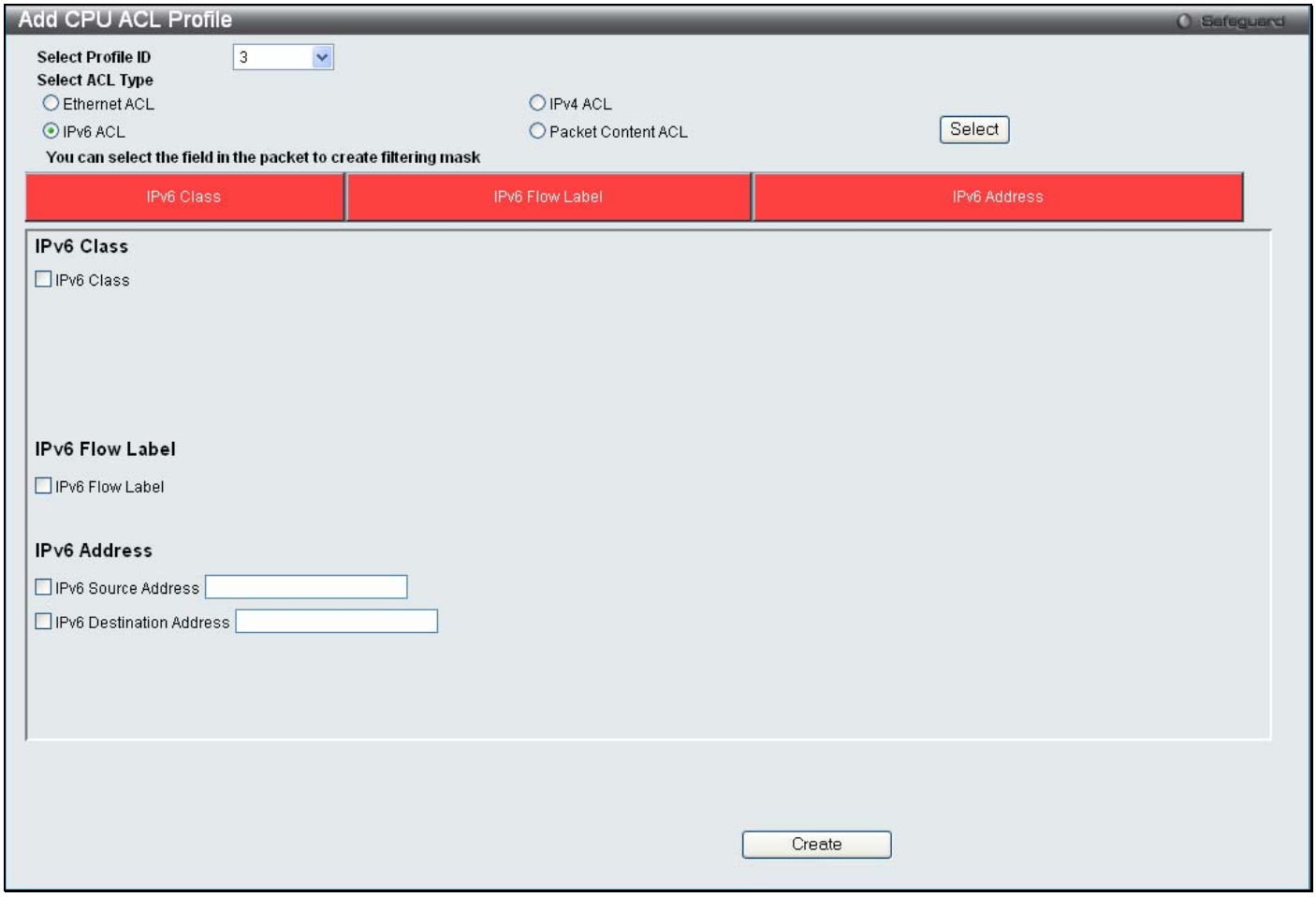


Figure 6 - 27. Add CPU ACL Profile window for IPv6

The following parameters may be configured for the IPv6 filter.

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *5*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content mask. This will change the menu according to the requirements for the type of profile. Select Ethernet to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 to instruct the Switch to examine the IP address in each frame's header. Select IPv6 to instruct the Switch to examine the IP address in each frame's header. Select Packet Content Mask to specify a mask to hide the content of the packet header.
IPv6 Class	Checking this field will instruct the Switch to examine the *class* field of the IPv6 header. This class field is a part of the packet header that is similar to the Type of Service (ToS) or Precedence bits field in IPv4.
IPv6 Flow Label	Checking this field will instruct the Switch to examine the *flow label* field of the IPv6 header. This flow label field is used by a source to label sequences of packets such as non-default quality of service or real time service packets.
IPv6 Source Address	The user may specify an IP address mask for the source IPv6 address by checking the corresponding box and entering the IP address mask.
IPv6 Destination Address	The user may specify an IP address mask for the destination IPv6 address by checking the corresponding box and entering the IP address mask.

Click **Apply** to set this entry in the Switch's memory.

To view the settings of a previously correctly created profile, click the corresponding **Show Details** button on the **CPU Access Profile List** window to view the following window:

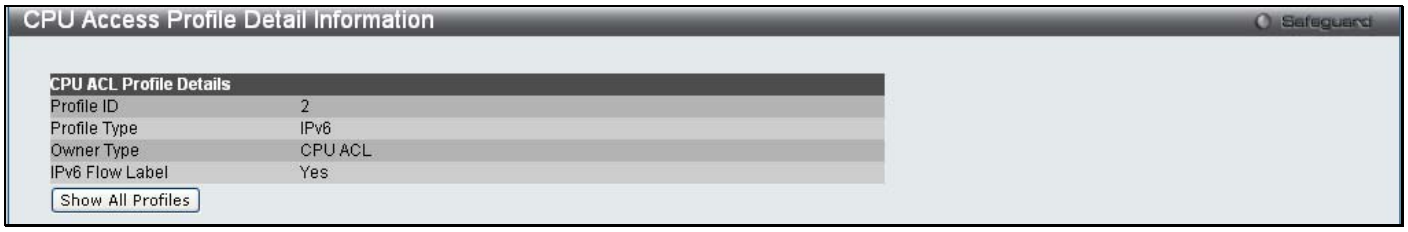


Figure 6 - 28. CPU Access Profile Detail Information window for IPv6

The window shown below is the **Add CPU ACL Profile** window for Packet Content.

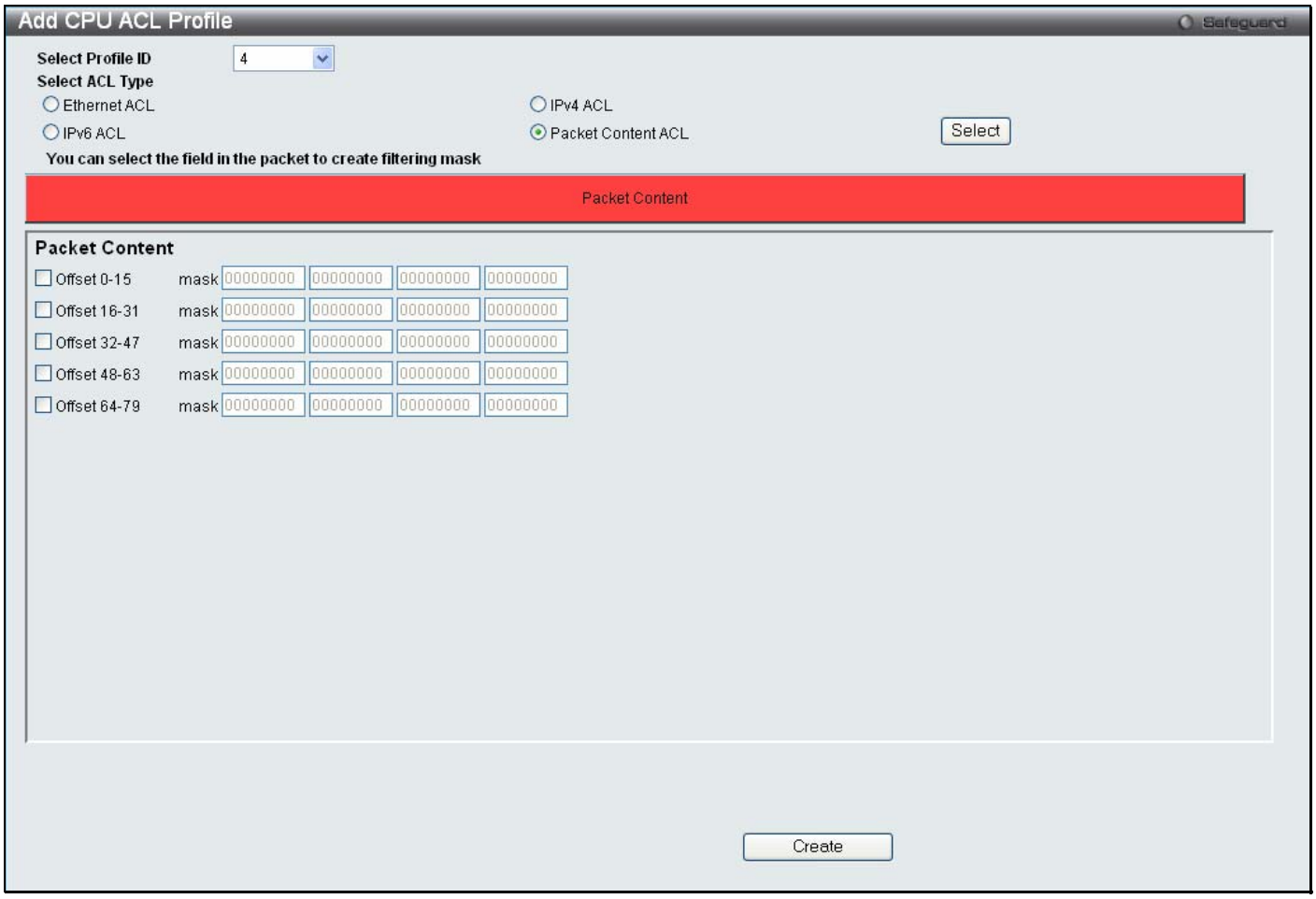

Add CPU ACL Profile
Safeguard
Select Profile ID 4
Select ACL Type
Ethernet ACL
IPv4 ACL
IPv6 ACL
Packet Content ACL
Select
You can select the field in the packet to create filtering mask
Packet Content
Packet Content
Offset 0-15 mask 00000000 00000000 00000000 00000000
Offset 16-31 mask 00000000 00000000 00000000 00000000
Offset 32-47 mask 00000000 00000000 00000000 00000000
Offset 48-63 mask 00000000 00000000 00000000 00000000
Offset 64-79 mask 00000000 00000000 00000000 00000000
Create

Figure 6 - 29. Add CPU ACL Profile window for Packet Content

The following parameters may be configured for the Packet Content filter.

Parameter	Description
Select Profile ID	Use the drop-down menu to select a unique identifier number for this profile set. This value can be set from *1* to *5*.
Select ACL Type	Select profile based on Ethernet (MAC Address), IPv4 address, IPv6 address, or packet content mask. This will change the menu according to the requirements for the type of profile. Select Ethernet to instruct the Switch to examine the layer 2 part of each packet header. Select IPv4 to instruct the Switch to examine the IP address in each frame's header. Select IPv6 to instruct the Switch to examine the IP address in each frame's header. Select Packet Content Mask to specify a mask to hide the content of the packet header.
Offset	This field will instruct the Switch to mask the packet header beginning with the offset value

	specified: • *0-15* - Enter a value in hex form to mask the packet from the beginning of the packet to the 15th byte. • *16-31* – Enter a value in hex form to mask the packet from byte 16 to byte 31. • *32-47* – Enter a value in hex form to mask the packet from byte 32 to byte 47. • *48-63* – Enter a value in hex form to mask the packet from byte 48 to byte 63. • *64-79* – Enter a value in hex form to mask the packet from byte 64 to byte 79.

Click **Apply** to set this entry in the Switch's memory.

To view the settings of a previously correctly created profile, click the corresponding **Show Details** button on the **CPU Access Profile List** window to view the following window:

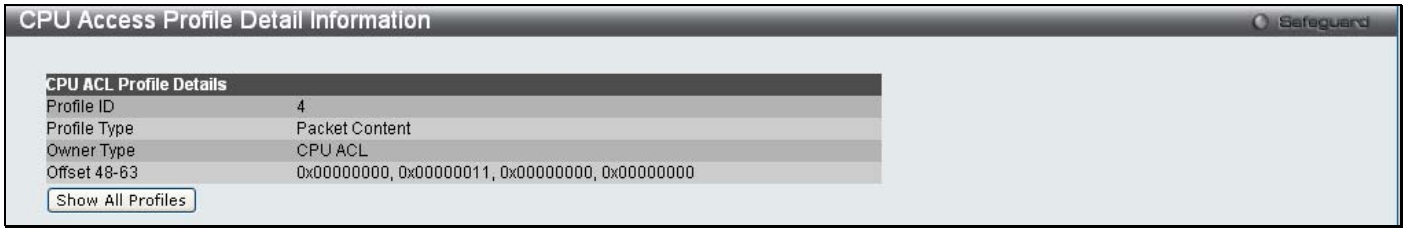


Figure 6 - 30. CPU Access Profile Detail Information window for Packet Content

To establish the rule for a previously created CPU Access Profile:

To configure the Access Rules for Ethernet, open the **CPU Access Profile List** window and click **Add/View Rules** for an Ethernet entry. This will open the following window.

Figure 6 - 31. CPU Access Rule List window for Ethernet

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

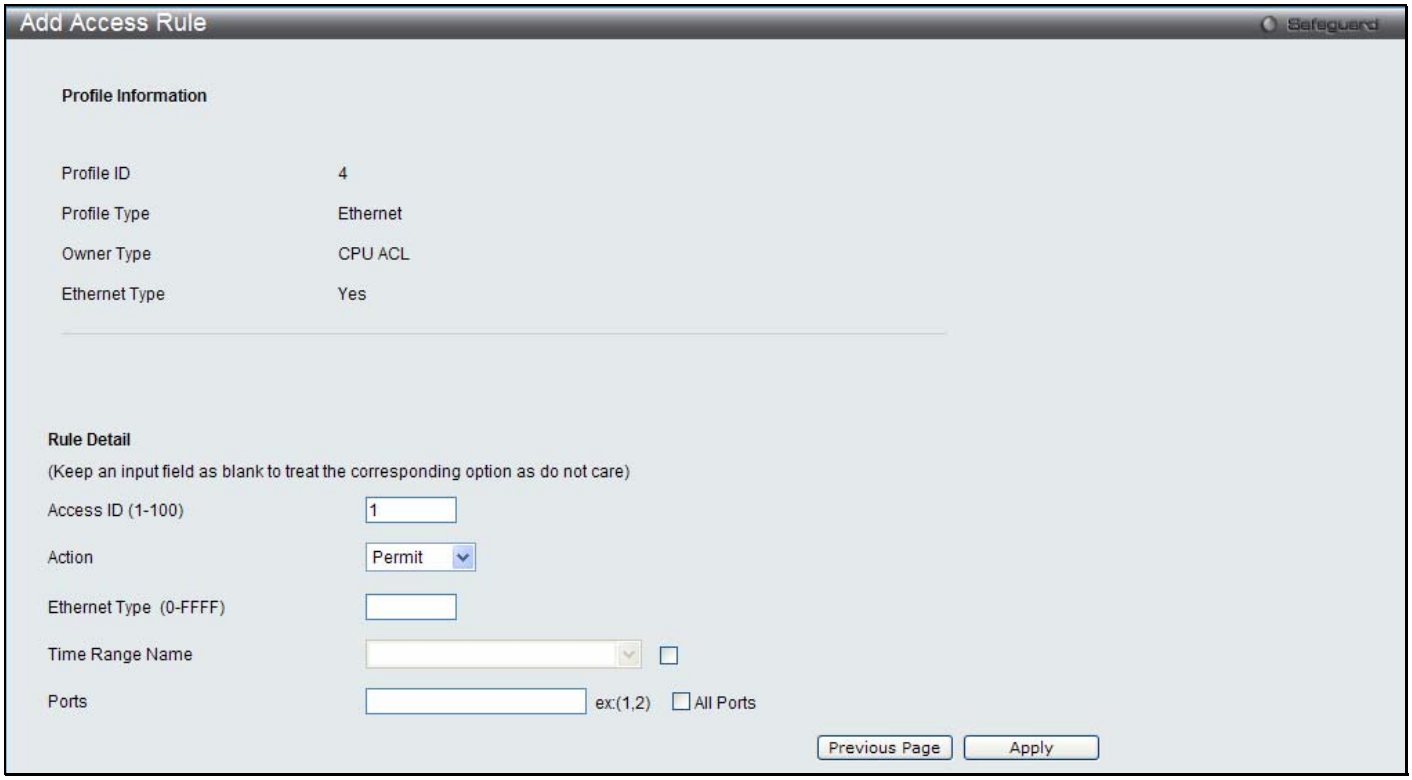


Figure 6 - 32. Add Access Rule window for Ethernet

To set the Access Rule for Ethernet, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-100)	Type in a unique identifier number for this access. This value can be set from *1* to *100*.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.
Ethernet Type (0-FFFF)	Enter the appropriate Ethernet Type information.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **CPU Access Rule List** window to view the following window:

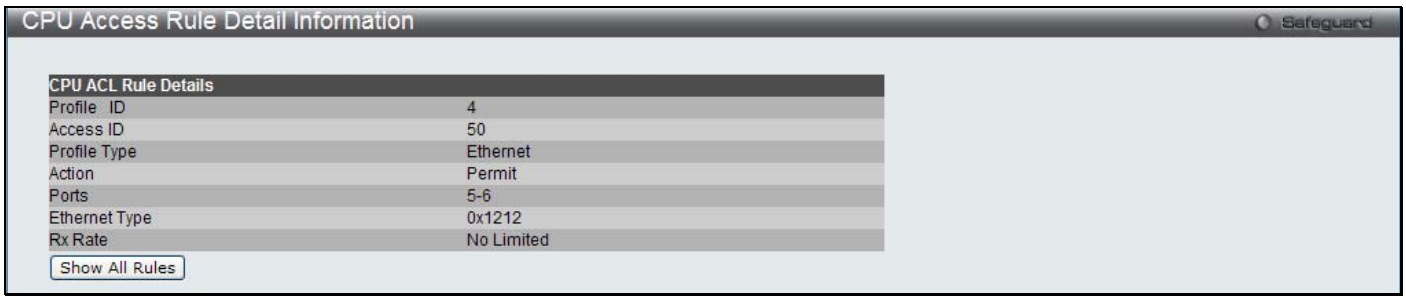


Figure 6 - 33. CPU Access Rule Detail Information window for Ethernet

To establish the rule for a previously created CPU Access Profile:

To configure the Access Rules for IP, open the **CPU Access Profile List** window and click **Add/View Rules** for an IP entry. This will open the following window.

Figure 6 - 34. CPU Access Rule List window for IPv4

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

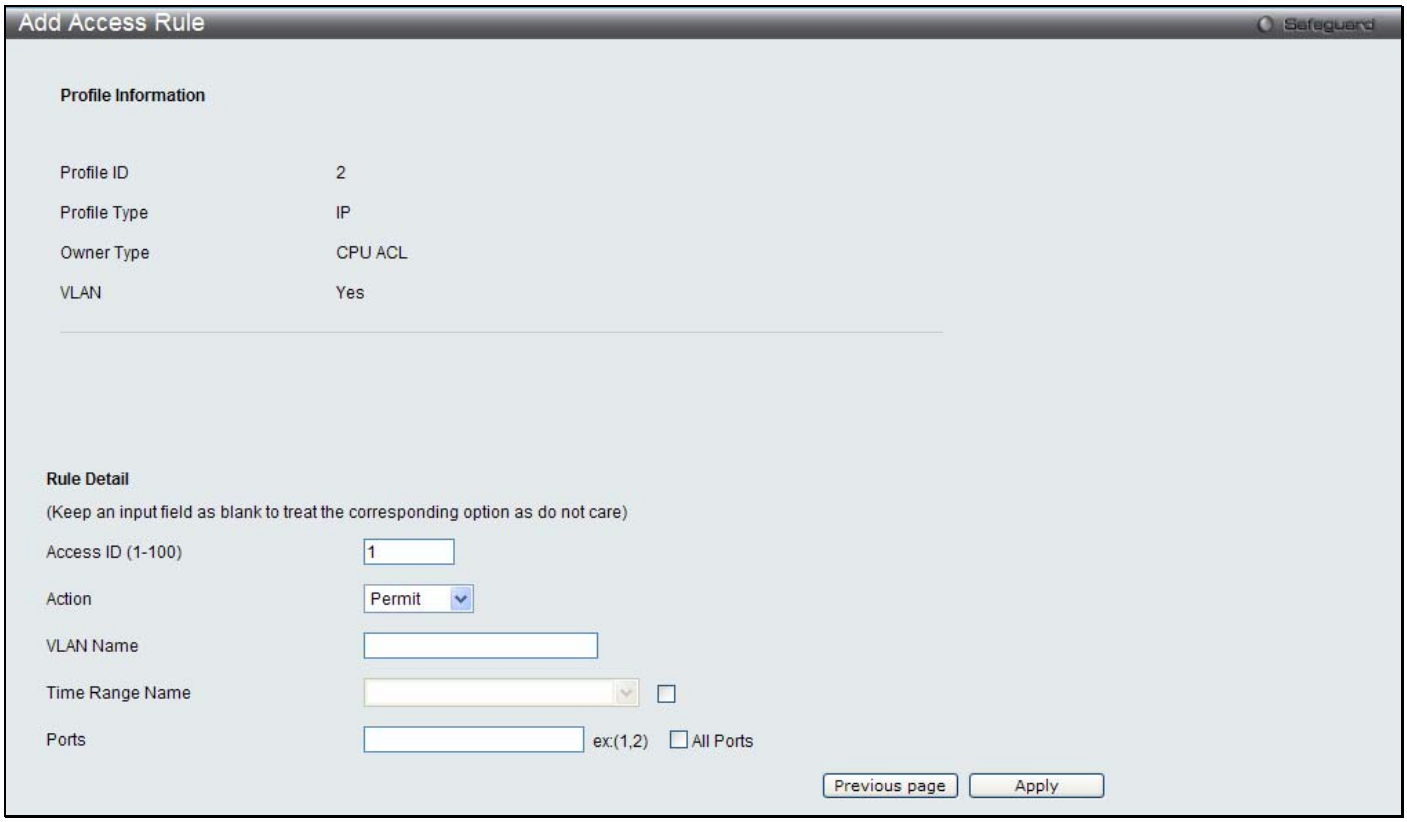


Figure 6 - 35. Add Access Rule window for IPv4

To set the Access Rule for IP, adjust the following parameters and click **Apply**

Parameter	Description
Access ID (1-100)	Type in a unique identifier number for this access. This value can be set from *1* to *100*.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.
VLAN Name	Allows the entry of a name for a previously configured VLAN.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.

Ports	Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **CPU Access Rule List** window to view the following window:

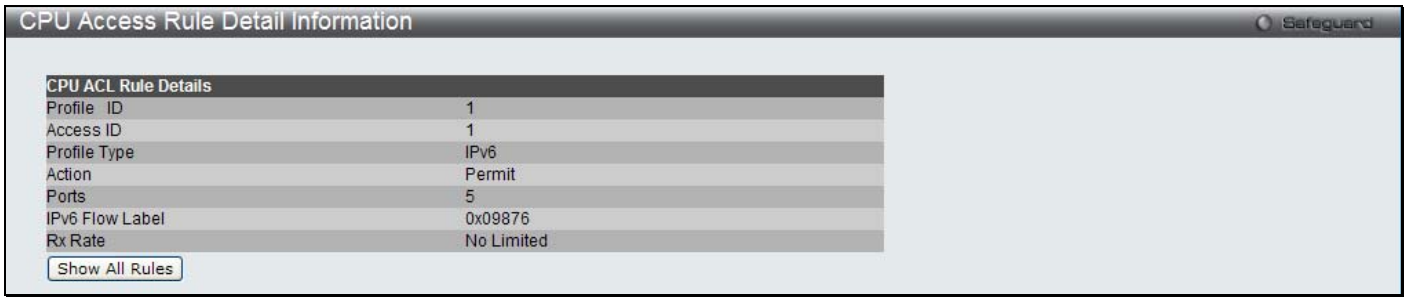


Figure 6 - 36. CPU Access Rule Detail Information window for IPv4

To establish the rule for a previously created CPU Access Profile:

To configure the Access Rules for IP, open the **CPU Access Profile List** window and click **Add/View Rules** for an IPv6 entry. This will open the following window.

Figure 6 - 37. CPU Access Rule List window for IPv6

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

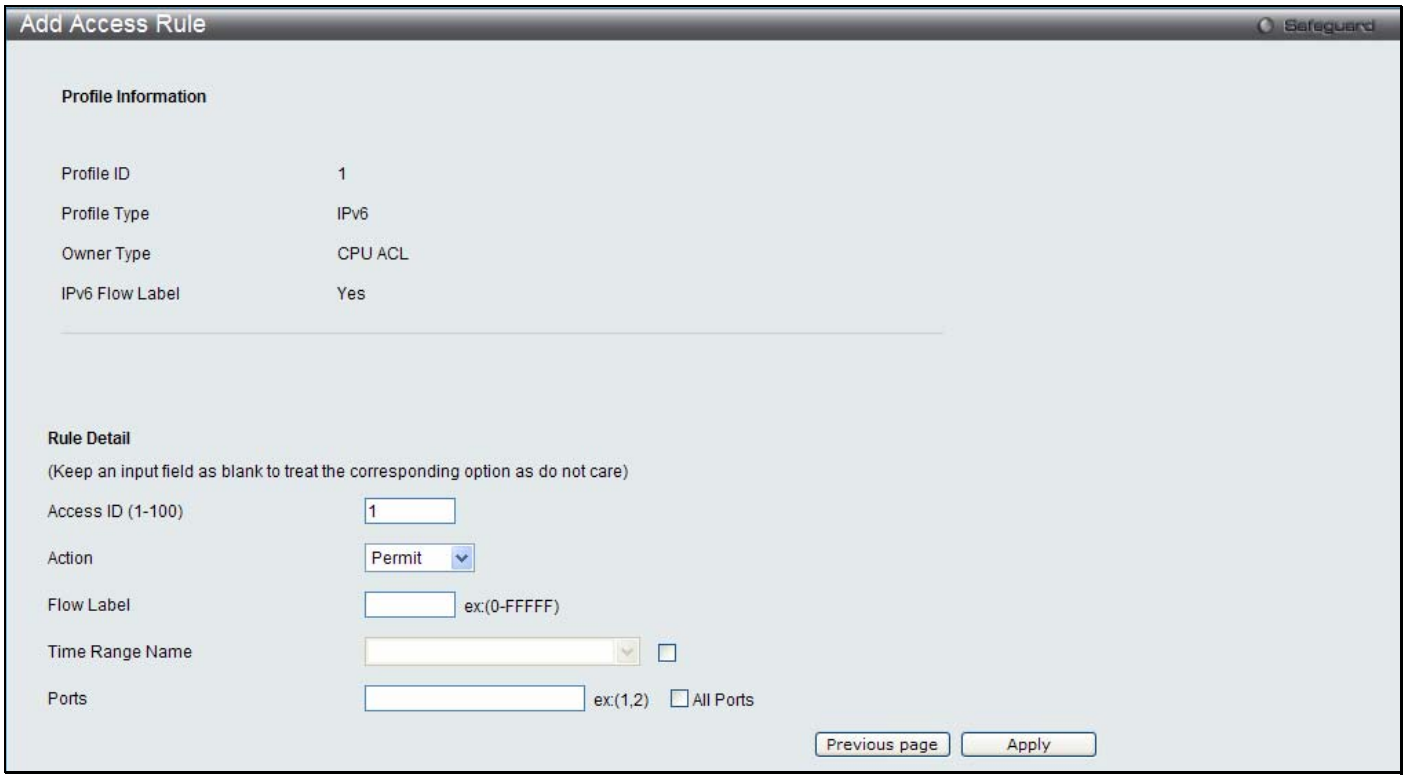


Figure 6 - 38. Add Access Rule window for IPv6

To set the Access Rule for IPv6, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-100)	Type in a unique identifier number for this access. This value can be set from *1* to *100*.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.
Flow Label	Configuring this field, in hex form, will instruct the Switch to examine the flow label field of the IPv6 header. This flow label field is used by a source to label sequences of packets such as non-default quality of service or real time service packets..
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **CPU Access Rule List** window to view the following window:

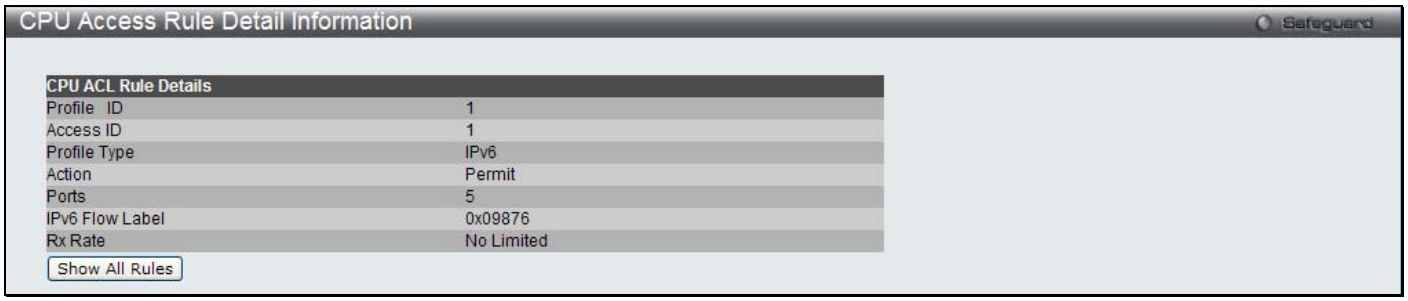


Figure 6 - 39. CPU Access Rule Detail Information window for IPv6

To establish the rule for a previously created CPU Access Profile:

To configure the Access Rules for IP, open the **CPU Access Profile List** window and click **Add/View Rules** for a Packet Content entry. This will open the following window.

Figure 6 - 40. CPU Access Rule List window for Packet Content

To remove a previously created rule, click the corresponding **Delete Rules** button. To add a new Access Rule, click the **Add Rule** button:

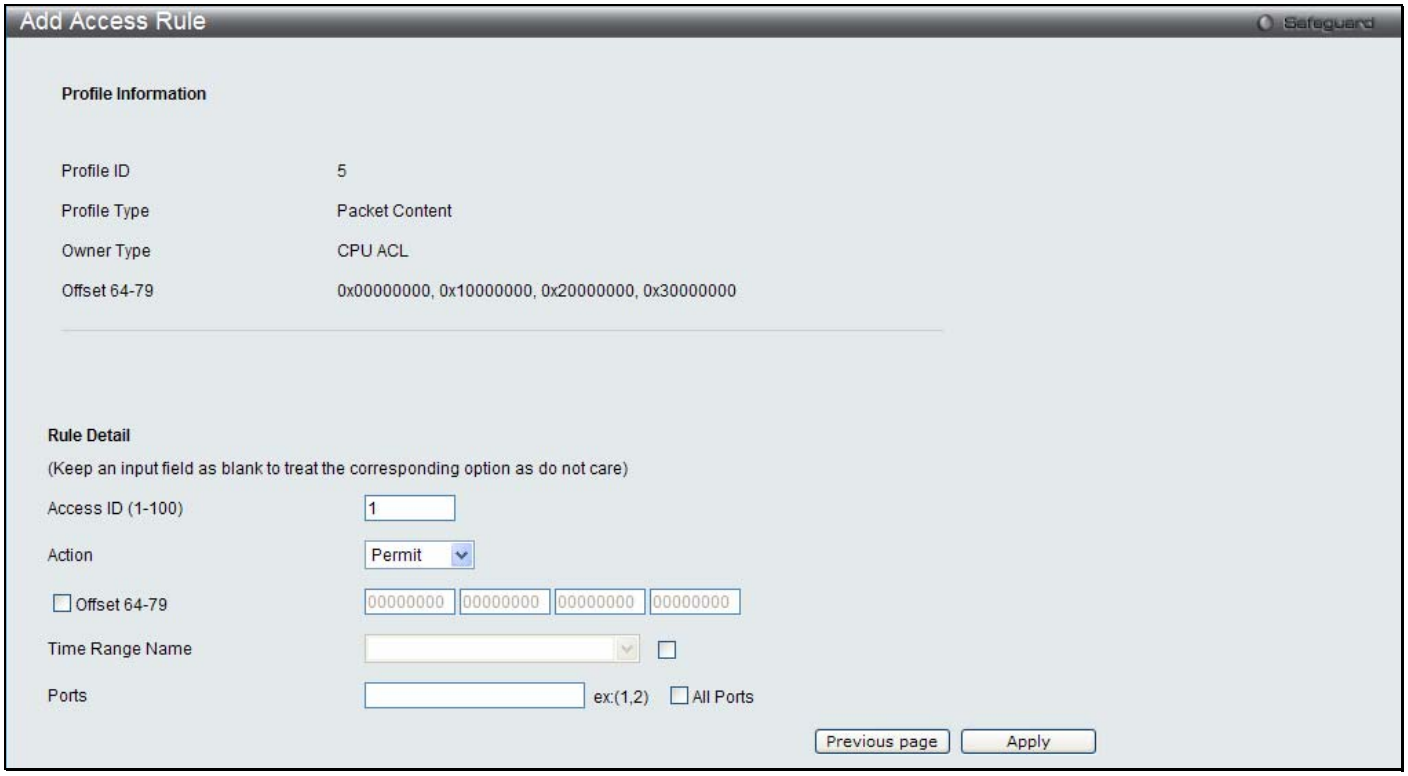


Figure 6 - 41. Add Access Rule window for Packet Content

To set the Access Rule for Packet Content, adjust the following parameters and click **Apply**.

Parameter	Description
Access ID (1-100)	Type in a unique identifier number for this access. This value can be set from *1* to *100*.
Action	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.
Offset	This field will instruct the Switch to mask the packet header beginning with the offset value specified: Offset 0-15 - Enter a value in hex form to mask the packet from the beginning of the packet to the 15th byte. Offset 16-31 - Enter a value in hex form to mask the packet from byte 16 to byte *31.* Offset 32-47 - Enter a value in hex form to mask the packet from byte 32 to byte 47. Offset 48-63 - Enter a value in hex form to mask the packet from byte 48 to byte 63. Offset 64-79 - Enter a value in hex form to mask the packet from byte 64 to byte 79.
Time Range Name	Tick the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range Settings** window. This will set specific times when this access rule will be implemented on the Switch.
Ports	Ticking the All Ports check box will denote all ports on the Switch.

To view the settings of a previously correctly configured rule, click the corresponding **Show Details** button on the **CPU Access Rule List** window to view the following window:

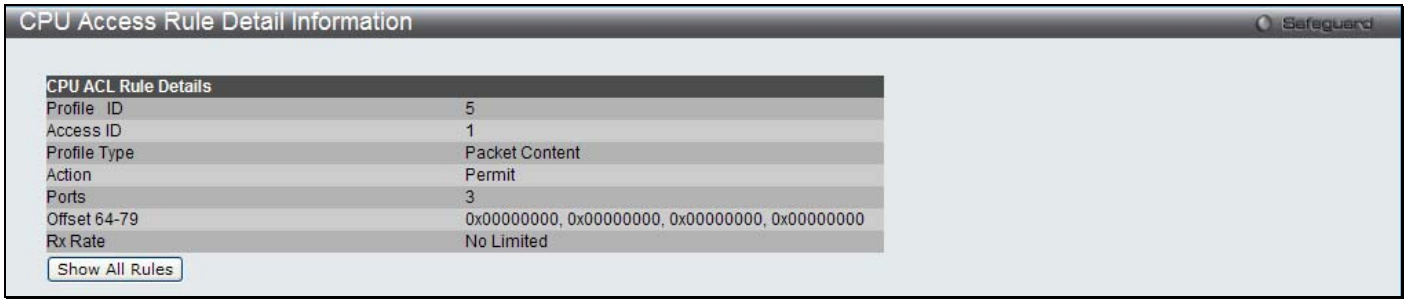


Figure 6 - 42. CPU Access Rule Detail Information window for Packet Content

Time Range Settings

In conjunction with the Access Profile feature, the time range settings determine a starting point and an ending point, based on days of the week, when an Access Profile configuration will be enabled on the Switch. Once configured here, the time range settings are to be applied to an access profile rule using the Access Profile table. The user may enter up to 64 time range entries on the Switch.

To view the following window, click **ACL > Time Range Settings**:

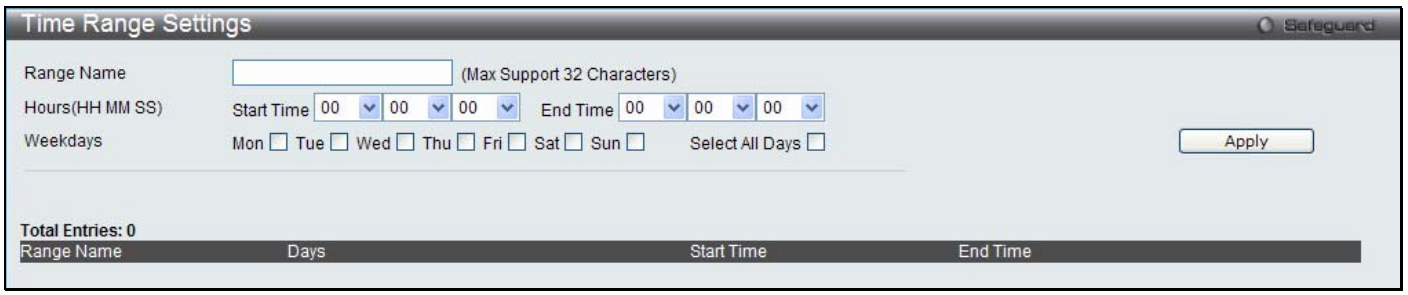


Figure 6 - 43. Time Range Settings window

The user may adjust the following parameters to configure a time range on the Switch:

Parameter	Description
Range Name	Enter a name of no more than 32 alphanumeric characters that will be used to identify this time range on the Switch. This range name will be used in the Access Profile table to identify the access profile and associated rule to be enabled during this time range.
Hours	This parameter is used to set the time in the day that this time range is to be enabled using the following parameters: • *Start Time* - Use this parameter to identify the starting time of the time range, in hours, minutes and seconds, based on the 24-hour time system. • *End Time* - Use this parameter to identify the ending time of the time range, in hours, minutes and seconds, based on the 24-hour time system.
Weekdays	Use the check boxes to select the corresponding days of the week that this time range is to be enabled. Tick the Select All Days check box to configure this time range for every day of the week.

Click **Apply** to implement changes made. Currently configured entries will be displayed in the **Time Range Information** table in the bottom half of the window shown above.

Section 7

Monitoring

Device Environment
Cable Diagnostic
CPU Utilization
Port Utilization
Packet Size
Packets
Errors
Port Access Control
Browse ARP Table
Browse VLAN
Browse Router Port
Browse MLD Router Port
Browse Session Table
IGMP Snooping Group
MLD Snooping Group
WAC Authenticating State
JWAC Host Table
MAC Address Table
System Log
MAC-based Access Control State

Device Environment

The device environment feature displays the Switch internal temperature status. This window is for the DGS-3200-16 only.

To view the following window, click **Monitoring** > **Device Environment**:

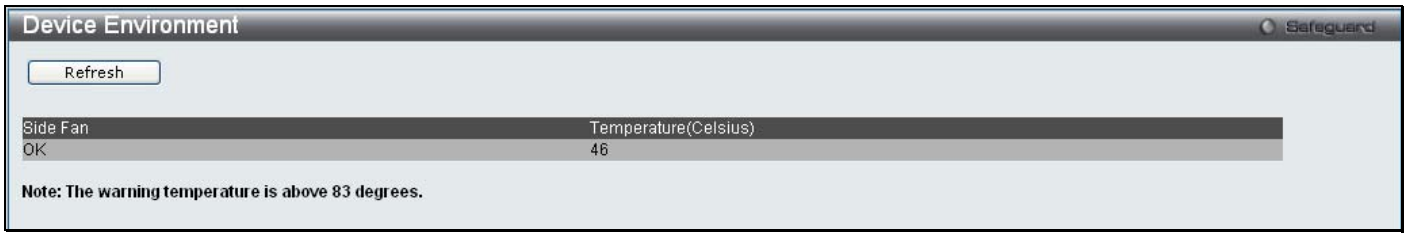


Figure 7 - 1. Device Environment window

Click **Refresh** to update the information displayed in this window.

Cable Diagnostic

The cable diagnostics feature is designed primarily for administrators or customer service representatives to verify and test copper cables; it can rapidly determine the quality of the cables and the types of error.

To view the following window, click **Monitoring** > **Cable Diagnostic**:

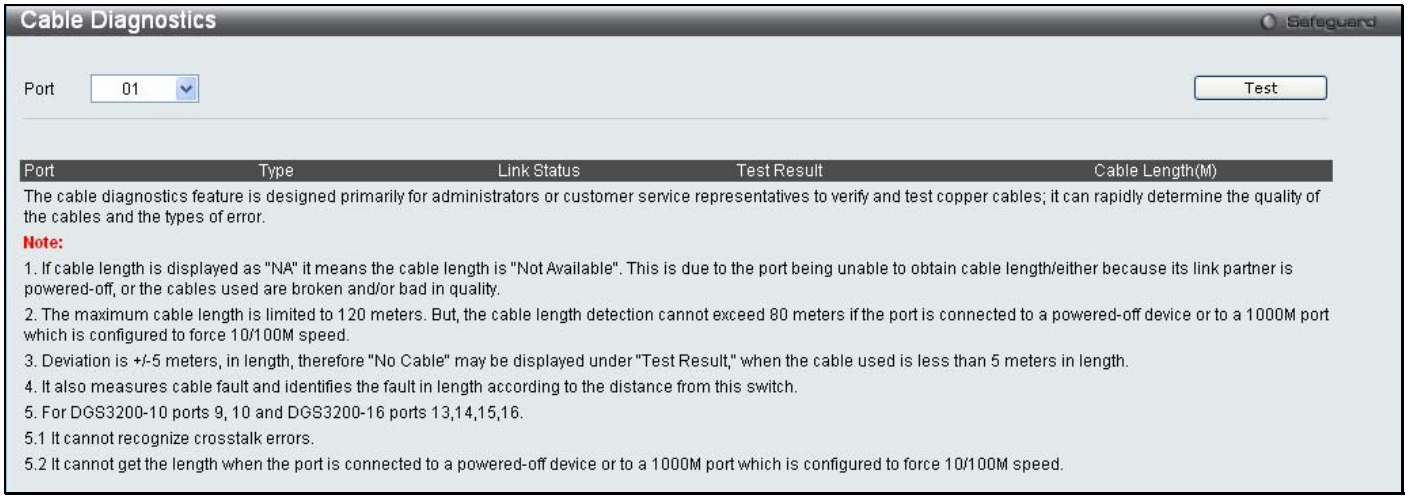

Cable Diagnostics
Safeguard
Port
01
Test
Port
Type
Link Status
Test Result
Cable Length(M)
The cable diagnostics feature is designed primarily for administrators or customer service representatives to verify and test copper cables; it can rapidly determine the quality of the cables and the types of error.
Note:
1. If cable length is displayed as "NA" it means the cable length is "Not Available". This is due to the port being unable to obtain cable length/either because its link partner is powered-off, or the cables used are broken and/or bad in quality.
2. The maximum cable length is limited to 120 meters. But, the cable length detection cannot exceed 80 meters if the port is connected to a powered-off device or to a 1000M port which is configured to force 10/100M speed.
3. Deviation is +/-5 meters, in length, therefore "No Cable" may be displayed under "Test Result," when the cable used is less than 5 meters in length.
4. It also measures cable fault and identifies the fault in length according to the distance from this switch.
5. For DGS3200-10 ports 9, 10 and DGS3200-16 ports 13,14,15,16.
5.1 It cannot recognize crosstalk errors.
5.2 It cannot get the length when the port is connected to a powered-off device or to a 1000M port which is configured to force 10/100M speed.

Figure 7 - 2. Cable Diagnostic window

To view the cable diagnostics for a particular port, use the drop-down menu to choose the port and click **Test** The information will be displayed in this window.

Cable Diagnostics Notes

1. The following two conditions apply for DGS-3200-10 ports 9 and 10 and DGS-3200-16 ports 13, 14, 15, and 16: crosstalk errors cannot be recognized and the length cannot be obtained when the port is connected to a 1000Mbytes port which is either forced to 10/100Mbytes or powered down.
2. If cable length is displayed as “NA,” this means the cable length is “Not Available”.
3. The cable length cannot exceed 80 meters if the port is connected to a powered-off device or to a port which is configured to force 10/100Mbytes speed.
4. Accurate measurement cannot be obtained when the cable is shorter than 1 meter.
5. The error deviation is +/-5 meters in length.
6. Cable fault is measured and the fault length is identified according to the distance from the switch.

CPU Utilization

Users can display the percentage of the CPU being used, expressed as an integer percentage and calculated as a simple average by time interval.

To view the following window, click **Monitoring** > **CPU Utilization**:

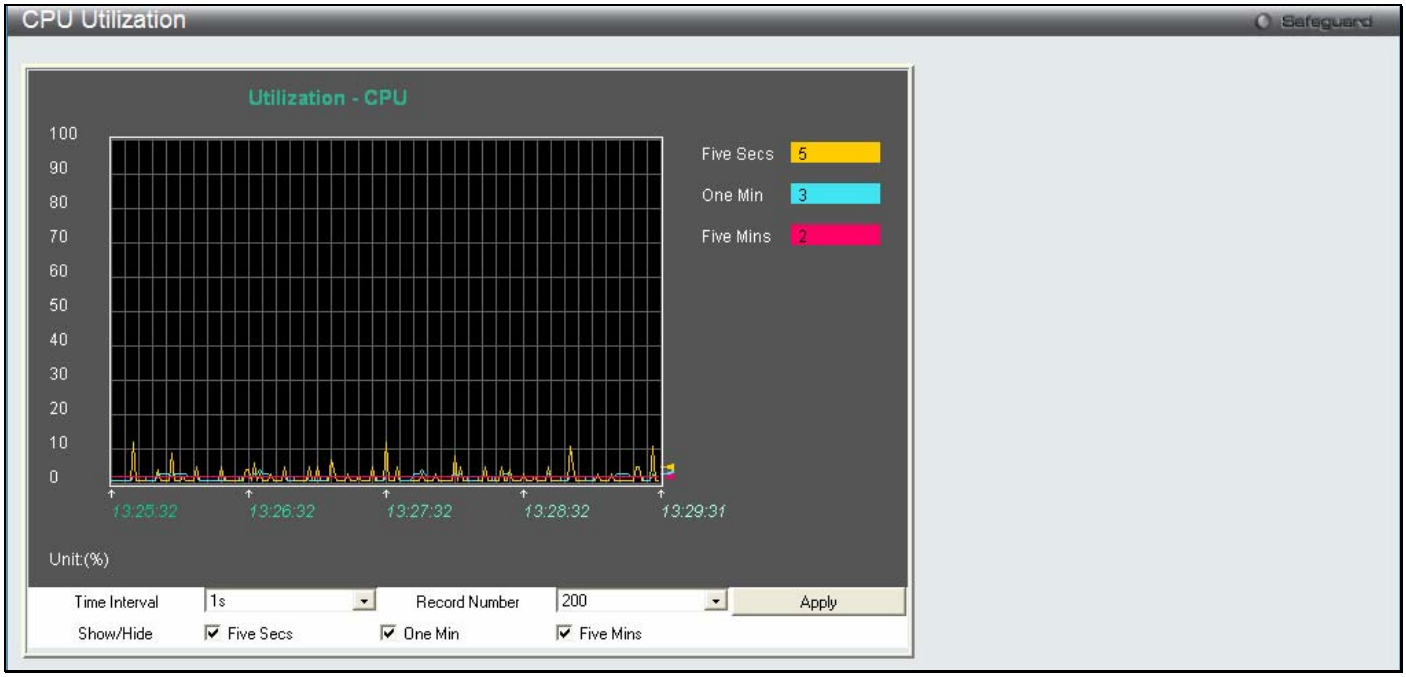


Figure 7 - 3. CPU Utilization window

To view the CPU utilization by port, use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port. Click **Apply** to implement the configured settings. The window will automatically refresh with new updated statistics.

Change the view parameters as follows:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Show/Hide	Check whether or not to display Five Secs, One Min, and Five Mins.

Port Utilization

Users can display the percentage of the total available bandwidth being used on the port.

To view the following window, click **Monitoring** > **Port Utilization**:

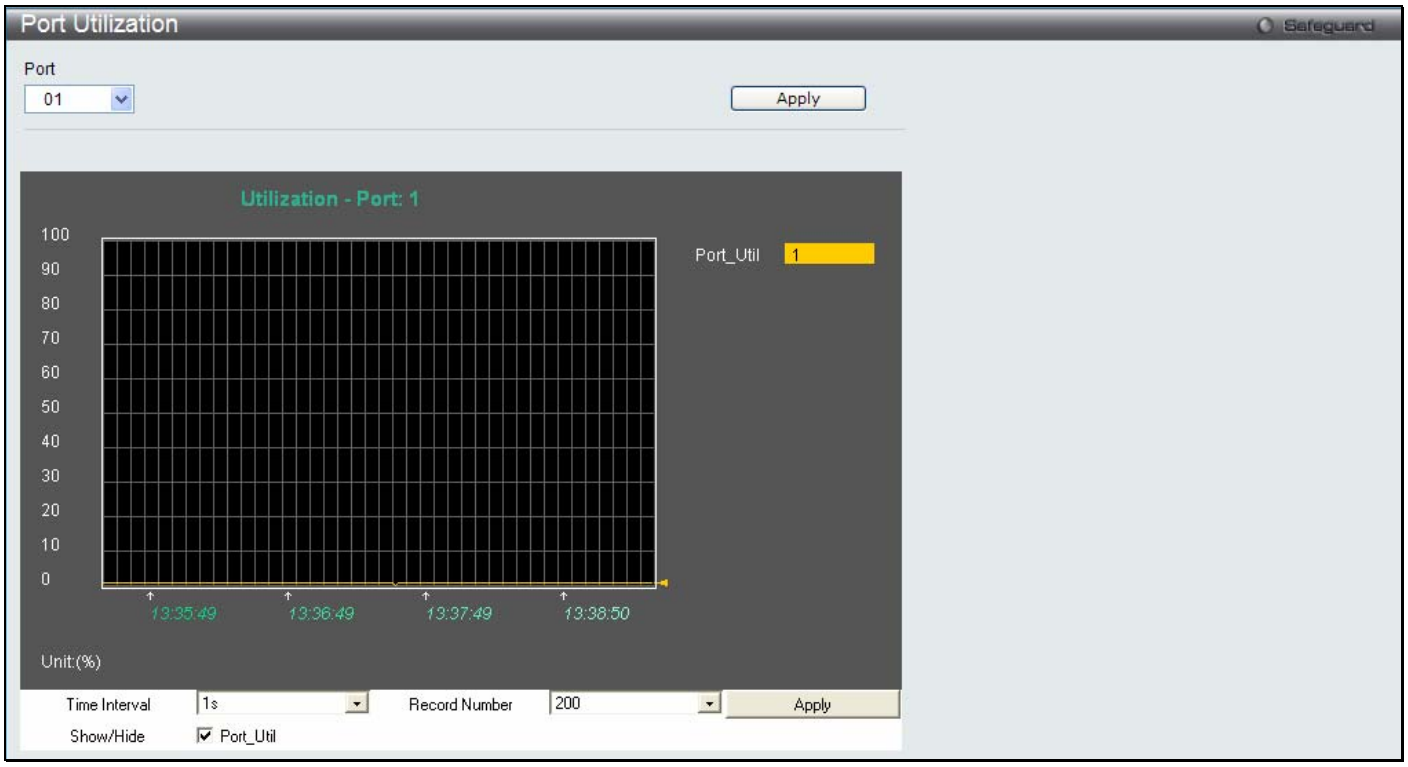


Figure 7 - 4. Port Utilization window

To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

Change the view parameters as follows:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Show/Hide	Check whether or not to display Port Util.

Packet Size

Users can display packets received by the Switch, arranged in six groups and classed by size, as either a line graph or a table. Two windows are offered. To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

To view the following windows, click **Monitoring** > **Packet Size**:

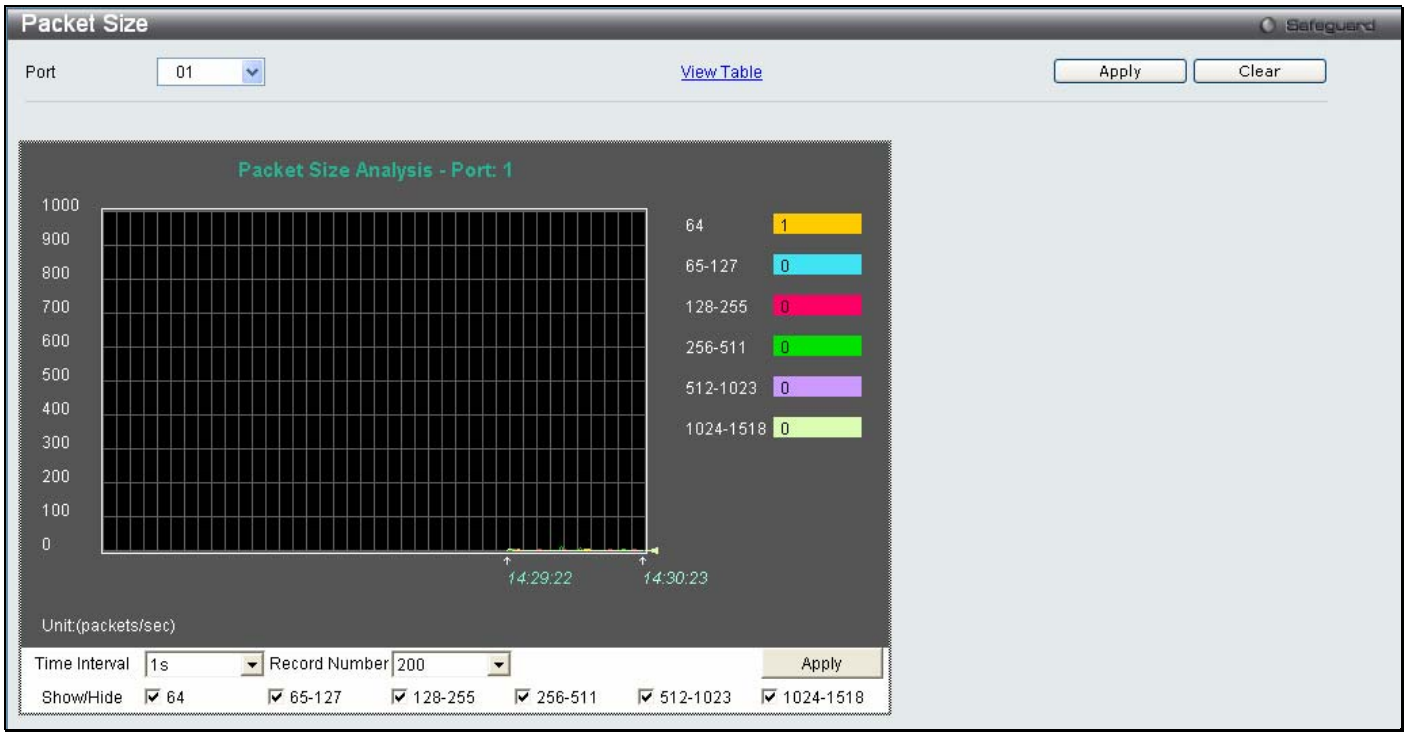


Figure 7 - 5. Packet Size window

To view the **Packet Size Table** window, click the link View Table, which will show the following table:

Figure 7 - 6. Packet Size Table window

The following fields can be set or viewed:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is 200.
64	The total number of packets (including bad packets) received that were 64 octets in length (excluding framing bits but including FCS octets).
65-127	The total number of packets (including bad packets) received that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets).
128-255	The total number of packets (including bad packets) received that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets).
256-511	The total number of packets (including bad packets) received that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets).
512-1023	The total number of packets (including bad packets) received that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets).
1024-1518	The total number of packets (including bad packets) received that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets).
Show/Hide	Check whether or not to display 64, 65-127, 128-255, 256-511, 512-1023, and 1024-1518 packets received.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Graphic	Clicking this button instructs the Switch to display a line graph rather than a table.

Packets

The Web manager allows various packet statistics to be viewed as either a line graph or a table. Six windows are offered.

Received (RX)

To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

To view the following windows, click **Monitoring > Packets > Received (RX)**:

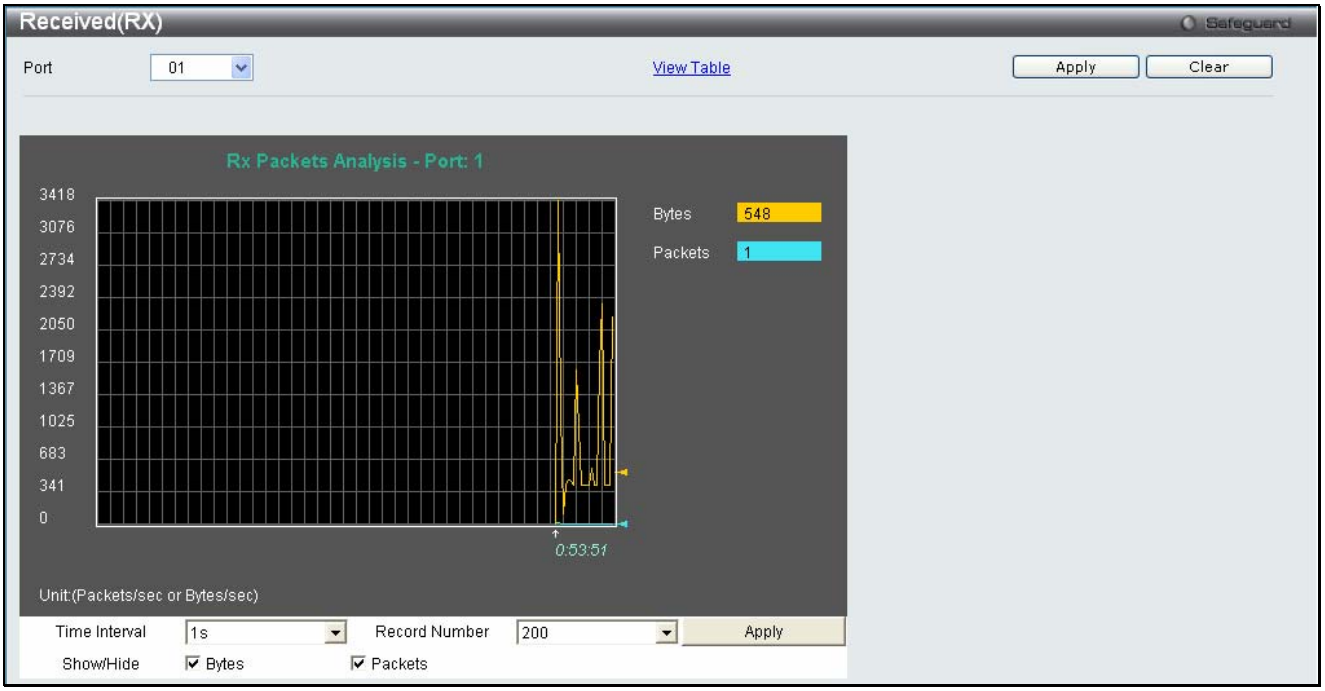


Figure 7 - 7. Received (RX) window (for Bytes and Packets)

To view the **Received (RX) Table** window, click View Table.

Figure 7 - 8. Received (RX) Table window (for Bytes and Packets)

The following fields may be set or viewed:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Bytes	Counts the number of bytes received on the port.
Packets	Counts the number of packets received on the port.
Unicast	Counts the total number of good packets that were received by a unicast address.
Multicast	Counts the total number of good packets that were received by a multicast address.
Broadcast	Counts the total number of good packets that were received by a broadcast address.
Show/Hide	Check whether to display Bytes and Packets.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Graphic	Clicking this button instructs the Switch to display a line graph rather than a table.

UMB_cast (RX)

To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

To view the following windows, click **Monitoring > Packets > UMB_cast (RX)**:

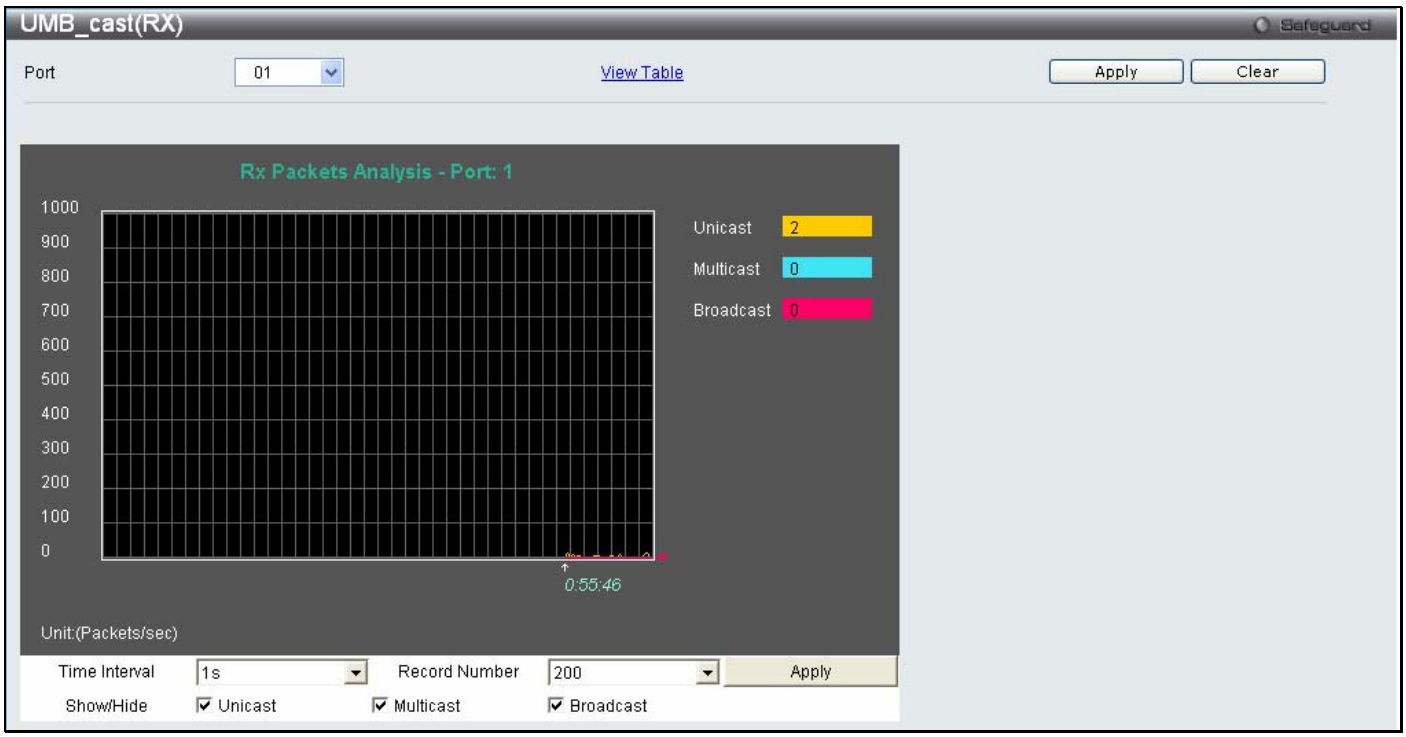


Figure 7 - 9. UMB_cast (RX) window (for Unicast, Multicast, and Broadcast Packets)

To view the **UMB_cast (RX) Table** window, click the View Table link.

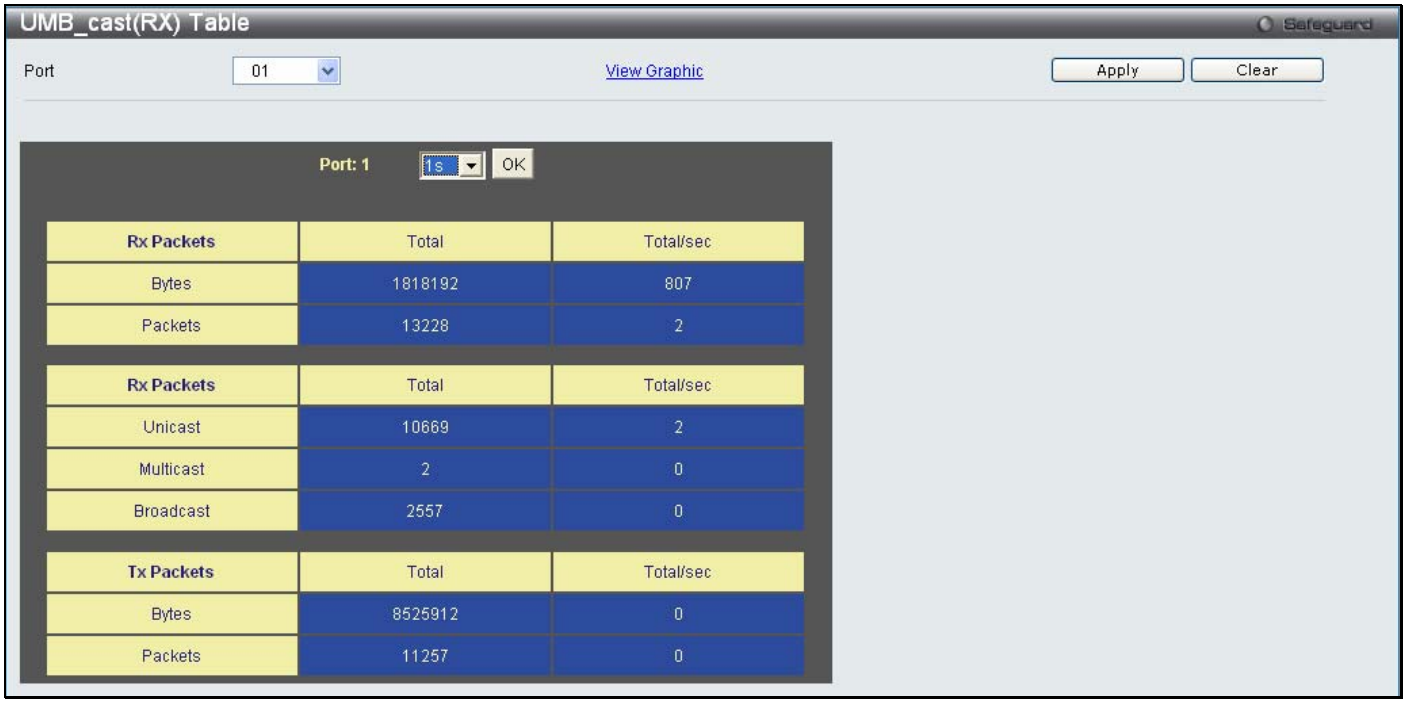


Figure 7 - 10. UMB_cast (RX) Table window (for Unicast, Multicast, and Broadcast Packets)

The following fields may be set or viewed:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Unicast	Counts the total number of good packets that were received by a unicast address.
Multicast	Counts the total number of good packets that were received by a multicast address.
Broadcast	Counts the total number of good packets that were received by a broadcast address.
Show/Hide	Check whether or not to display Multicast, Broadcast, and Unicast Packets.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Graphic	Clicking this button instructs the Switch to display a line graph rather than a table.

Transmitted (TX)

To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

To view the following windows, click **Monitoring** > **Packets** > **Transmitted (TX)**:

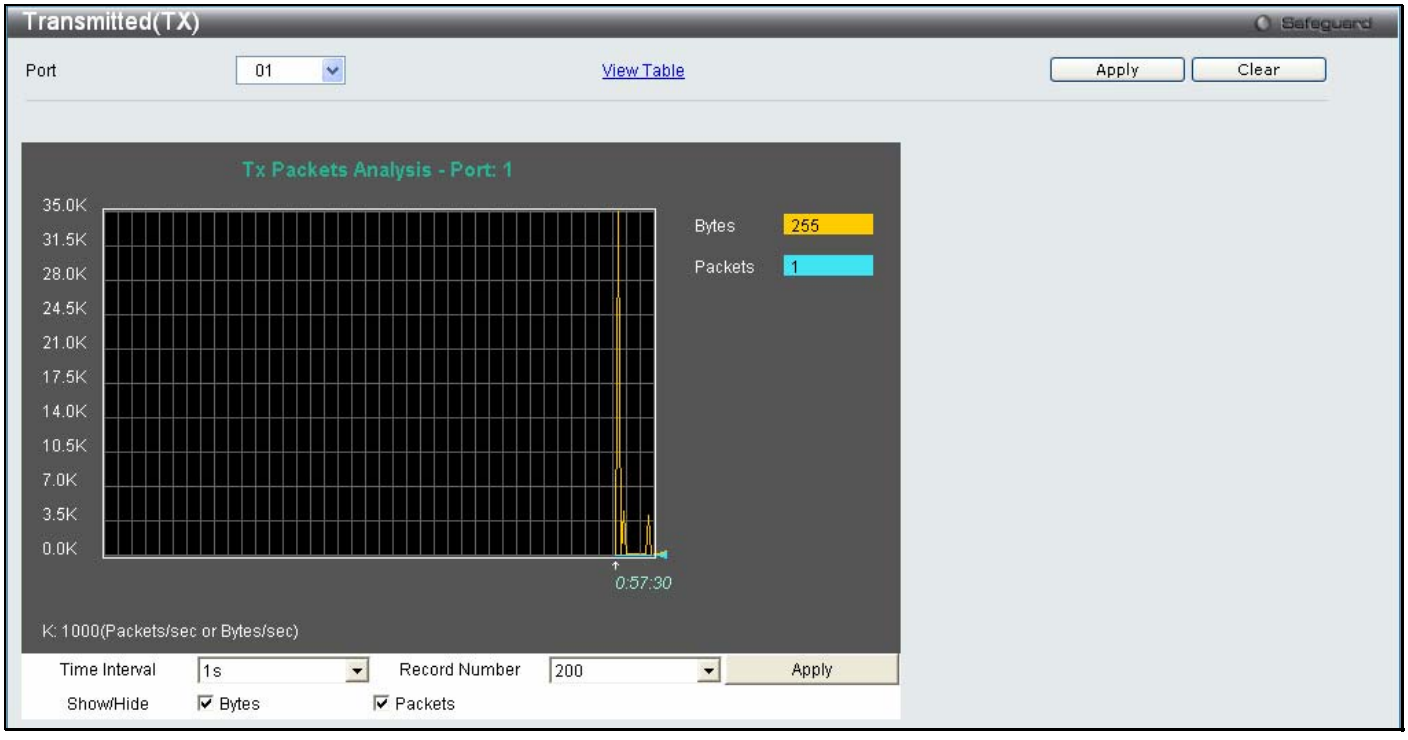


Figure 7 - 11. Transmitted (TX) window (for Bytes and Packets)

To view the **Transmitted (TX) Table** window, click the link View Table.

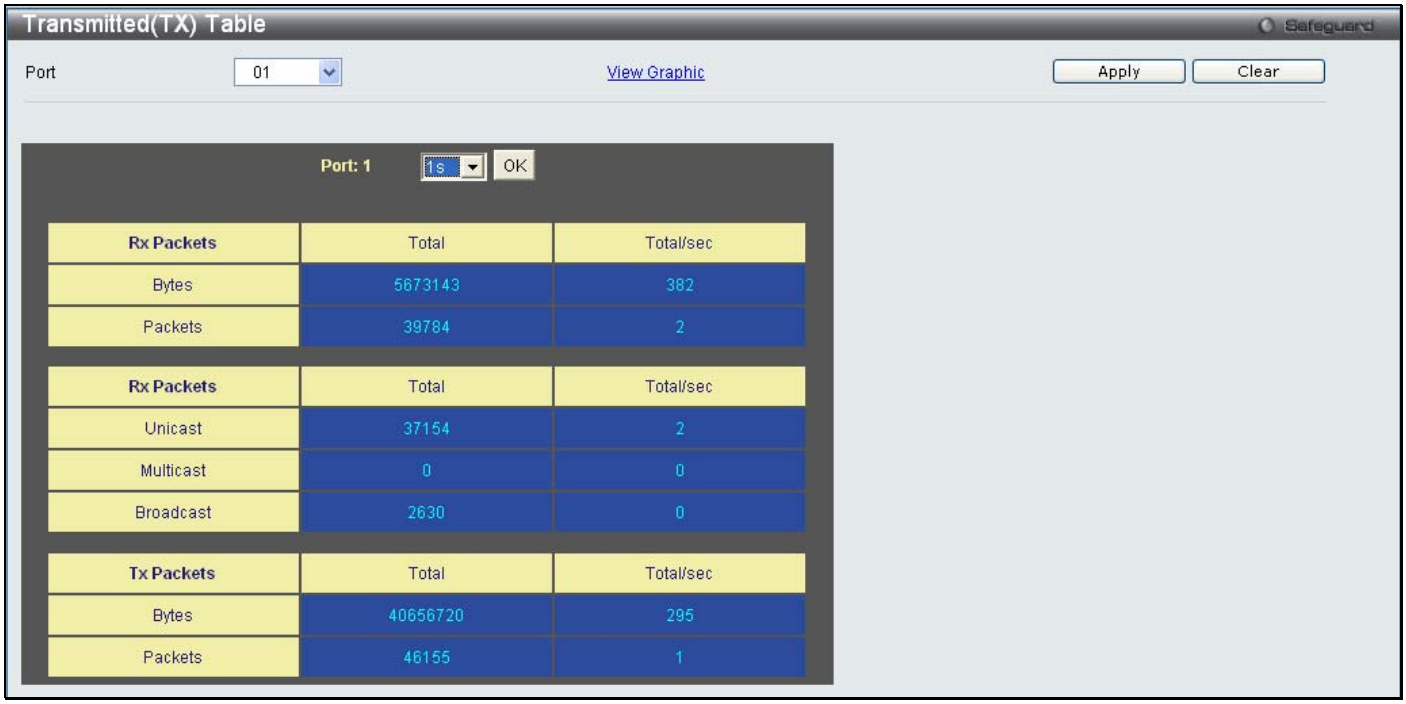


Figure 7 - 12. Transmitted (TX) Table window (for Bytes and Packets)

The following fields may be set or viewed:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Bytes	Counts the number of bytes successfully sent on the port.
Packets	Counts the number of packets successfully sent on the port.
Unicast	Counts the total number of good packets that were transmitted by a unicast address.
Multicast	Counts the total number of good packets that were transmitted by a multicast address.
Broadcast	Counts the total number of good packets that were transmitted by a broadcast address.
Show/Hide	Check whether or not to display Bytes and Packets.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Graphic	Clicking this button instructs the Switch to display a line graph rather than a table.

Errors

The Web manager allows port error statistics compiled by the Switch's management agent to be viewed as either a line graph or a table. Four windows are offered.

Received (RX)

To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

To view the following windows, click **Monitoring** > **Errors** > **Received (RX)**:

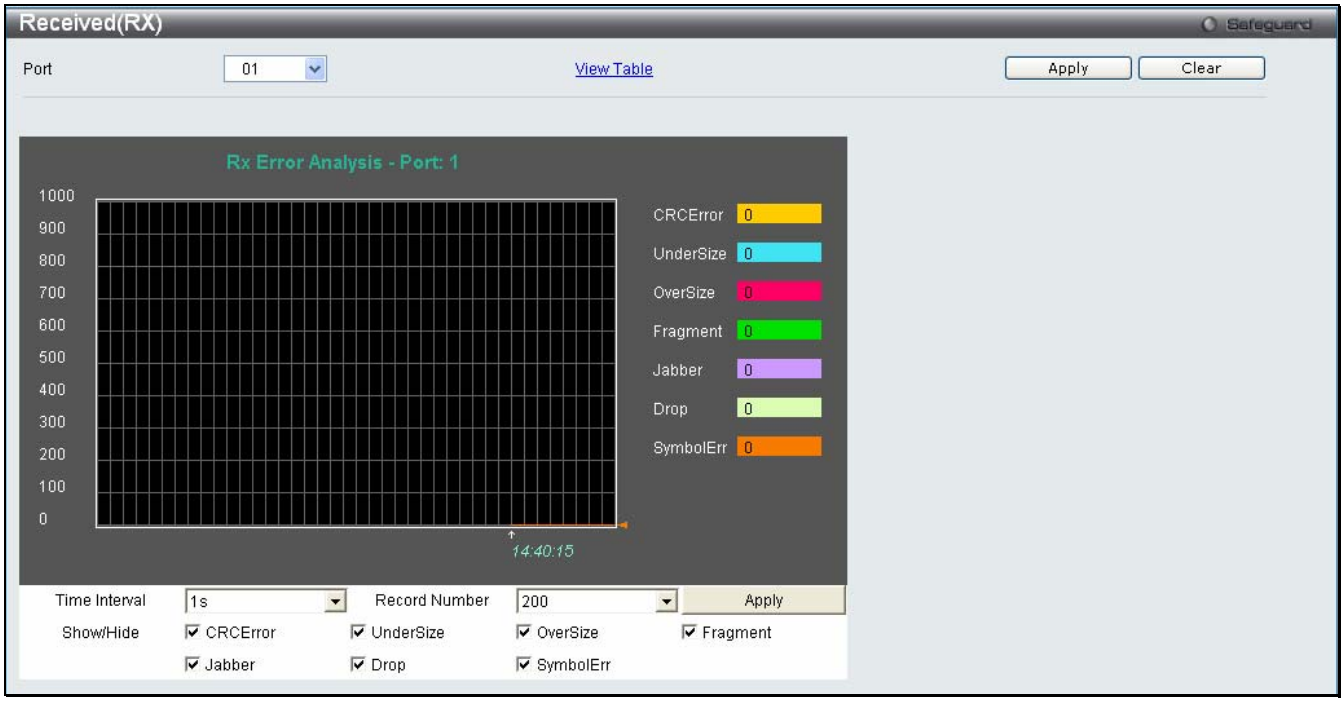


Figure 7- 13. Received (RX) window (for errors)

To view the **Received (RX) Table** window for errors, click the link **View Table**, which will show the following table:

Figure 7 - 14. Received (RX) Table window (for errors)

The following fields can be set:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
CRCError	Counts otherwise valid packets that did not end on a byte (octet) boundary.
UnderSize	The number of packets detected that are less than the minimum permitted packets size of 64 bytes and have a good CRC. Undersize packets usually indicate collision fragments, a normal network occurrence.
OverSize	Counts valid packets received that were longer than 1518 octets and less than the MAX_PKT_LEN. Internally, MAX_PKT_LEN is equal to 1536.
Fragment	The number of packets less than 64 bytes with either bad framing or an invalid CRC. These are normally the result of collisions.
Jabber	Counts invalid packets received that were longer than 1518 octets and less than the MAX_PKT_LEN. Internally, MAX_PKT_LEN is equal to 1536.
Drop	The number of packets that are dropped by this port since the last Switch reboot.
Symbol	Counts the number of packets received that have errors received in the symbol on the physical labor.
Show/Hide	Check whether or not to display CRCError, UnderSize, OverSize, Fragment, Jabber, Drop, and SymbolErr errors.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Graphic	Clicking this button instructs the Switch to display a line graph rather than a table.

Transmitted (TX)

To select a port to view these statistics for, select the port by using the Port pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

To view the following windows, click **Monitoring** > **Errors** > **Transmitted (TX)**:

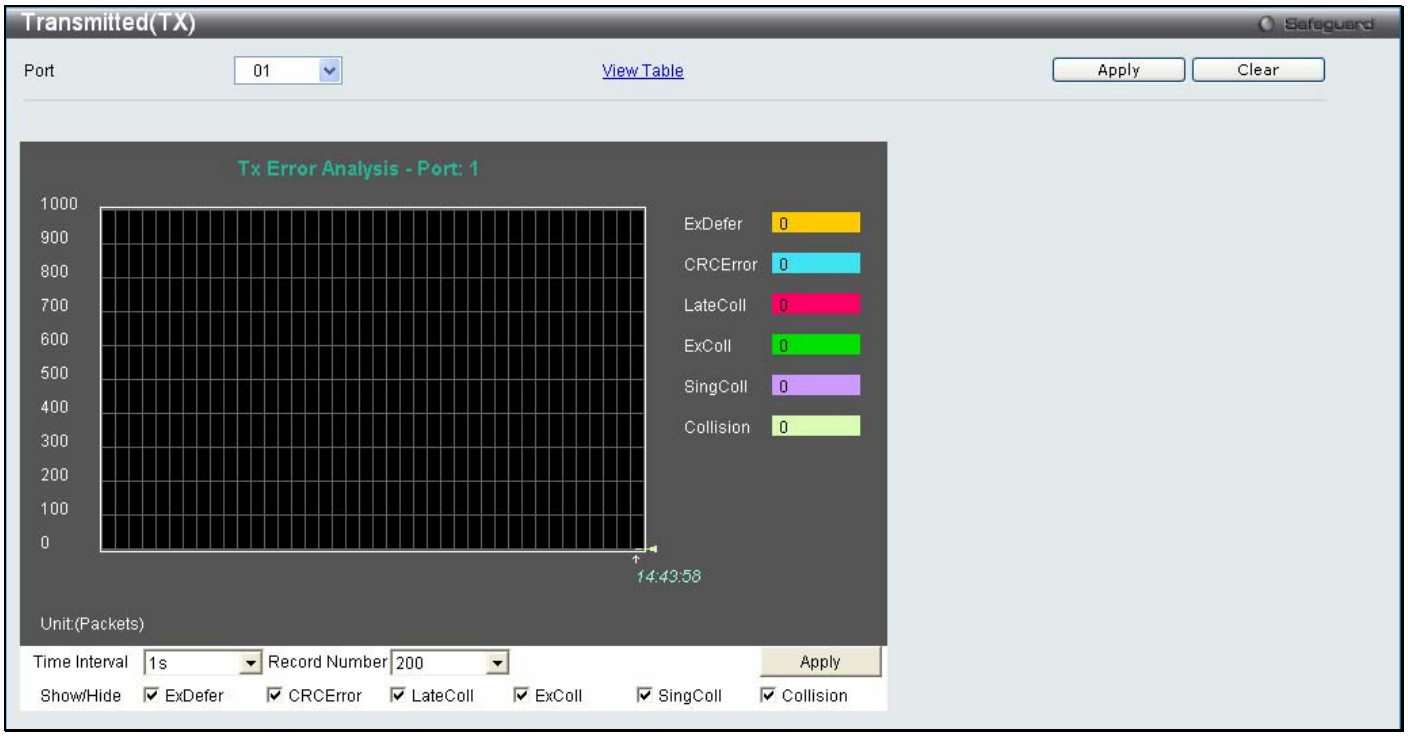


Figure 7- 15. Transmitted (TX) window (for errors)

To view the **Transmitted (TX) Table** window, click the link View Table, which will show the following table:

Figure 7- 16. Transmitted (TX) Table window (for errors)

The following fields may be set or viewed:

Parameter	Description
Port	Use the drop-down menu to choose the port that will display statistics.
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is 200.
ExDefer	Counts the number of packets for which the first transmission attempt on a particular interface was delayed because the medium was busy.
CRC Error	Counts otherwise valid packets that did not end on a byte (octet) boundary.
LateColl	Counts the number of times that a collision is detected later than 512 bit-times into the transmission of a packet.
ExColl	Excessive Collisions. The number of packets for which transmission failed due to excessive collisions.
SingColl	Single Collision Frames. The number of successfully transmitted packets for which transmission is inhibited by more than one collision.
Collision	An estimate of the total number of collisions on this network segment.
Show/Hide	Check whether or not to display ExDefer, CRCError, LateColl, ExColl, SingColl, and Collision errors.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Graphic	Clicking this button instructs the Switch to display a line graph rather than a table.

Port Access Control

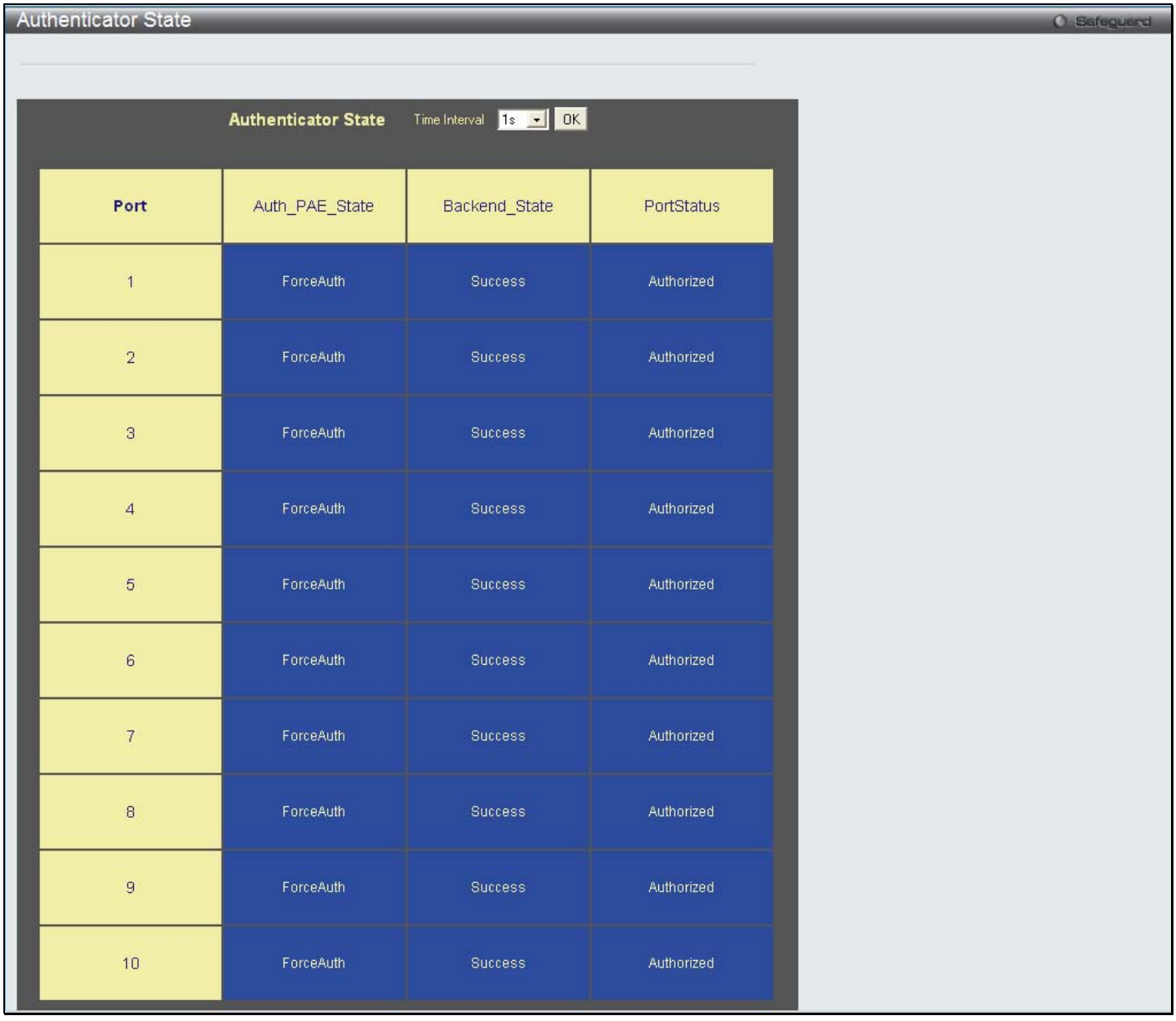
The following windows are used to monitor 802.1X statistics of the Switch, on a per port basis. To view the **Port Access Control** windows, open the **Monitoring** folder and click **Port Access Control**. There are seven monitoring windows in this section.

Authenticator State

The following section describes the 802.1x Status on the Switch.

Users can view the Authenticator State.

To view the following windows, click **Monitoring > Port Access Control > Authenticator State**:



Port	Auth_PAE_State	Backend_State	PortStatus
1	ForceAuth	Success	Authorized
2	ForceAuth	Success	Authorized
3	ForceAuth	Success	Authorized
4	ForceAuth	Success	Authorized
5	ForceAuth	Success	Authorized
6	ForceAuth	Success	Authorized
7	ForceAuth	Success	Authorized
8	ForceAuth	Success	Authorized
9	ForceAuth	Success	Authorized
10	ForceAuth	Success	Authorized

Figure 7 - 17. Authenticator State window for Port-based 802.1X

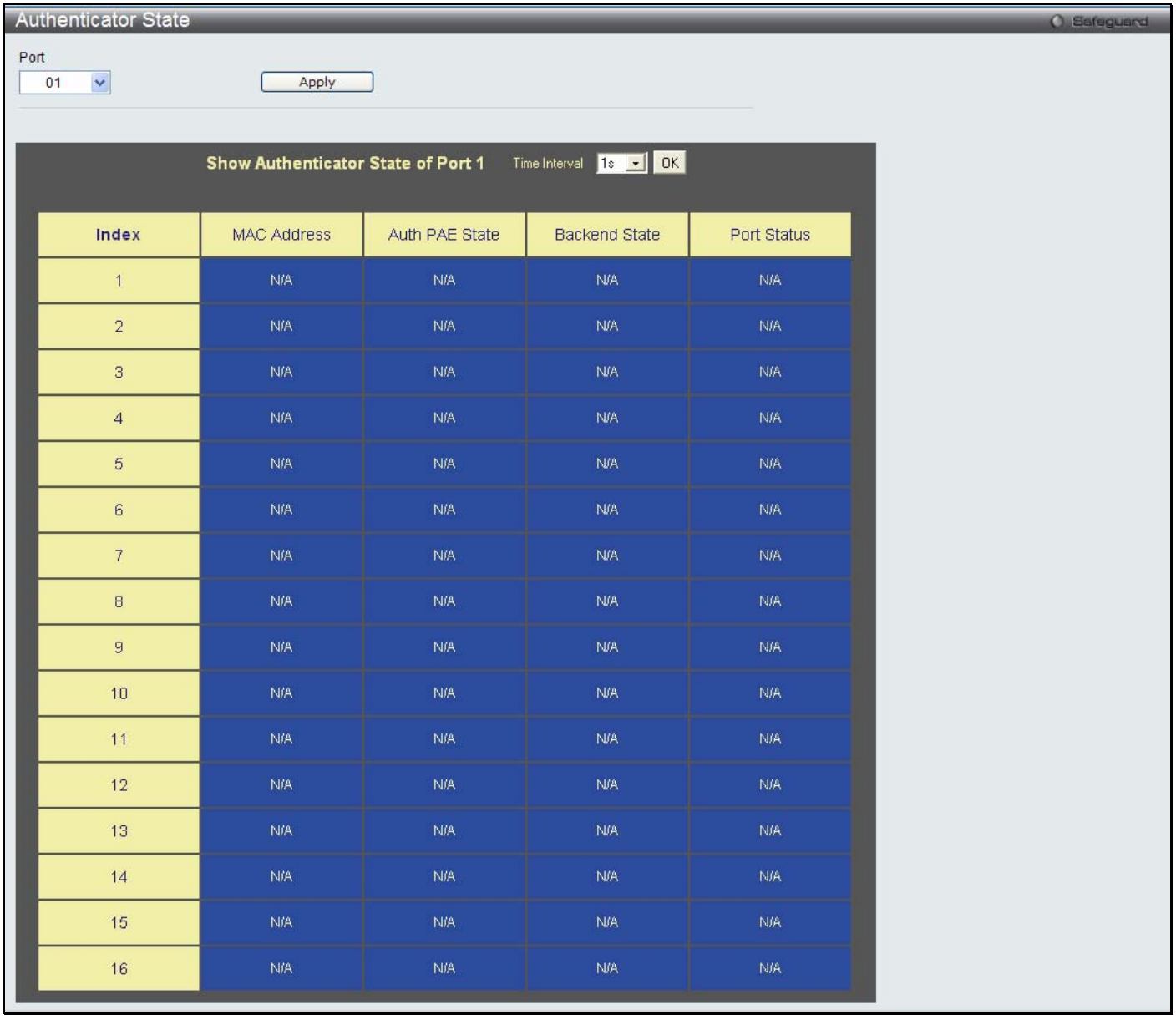


Figure 7 - 18. Authenticator State window – MAC-Based 802.1X

This window displays the Authenticator State for individual ports on a selected device. A polling interval between *1* and *60* seconds can be set using the drop-down menu at the top of the window and clicking **OK**.

The information on this window is described as follows:

Parameter	Description
Auth PAE State	The Authenticator PAE State value can be: Initialize, Disconnected, Connecting, Authenticating, Authenticated, Aborting, Held, Force_Auth, Force_Unauth, or N/A. N/A (Not Available) indicates that the port's authenticator capability is disabled.
Backend State	The Backend Authentication State can be Request, Response, Success, Fail, Timeout, Idle, Initialize, or N/A. N/A (Not Available) indicates that the port's authenticator capability is disabled.
Port Status	Controlled Port Status can be Authorized, Unauthorized, or N/A.
MAC Address	The MAC Address of the device of the corresponding index number.

Authenticator Statistics

Users can display tatistics objects for the Authenticator PAE associated with each port. An entry appears in this table for each port that supports the Authenticator function.

To view the following window, click **Monitoring > Port Access Control > Authenticator Statistics**:

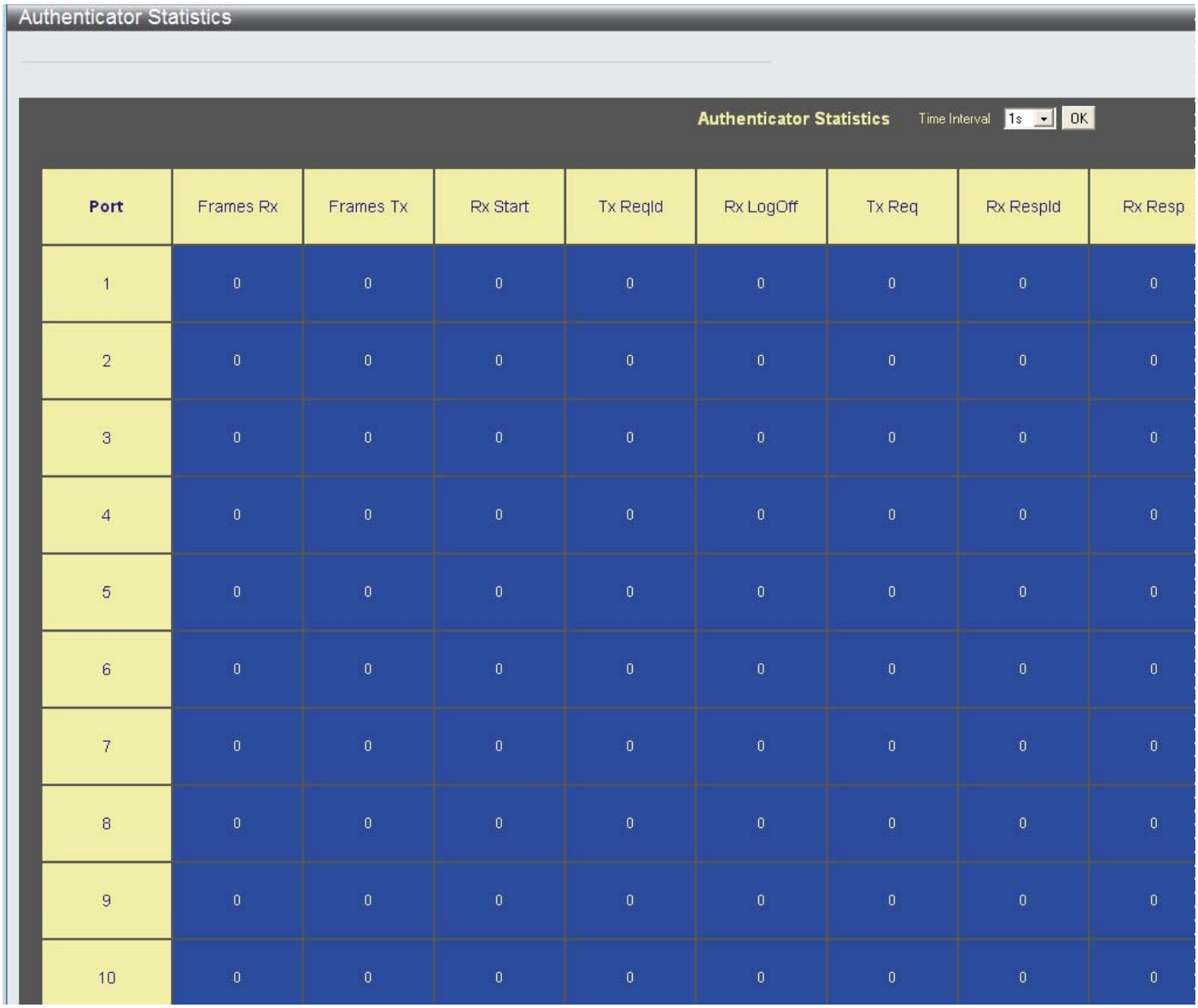

Authenticator Statistics
Authenticator Statistics
Time Interval
1s
OK
Port
Frames Rx
Frames Tx
Rx Start
Tx ReqId
Rx LogOff
Tx Req
Rx RespId
Rx Resp
1 0 0 0 0 0 0 0 0
2 0 0 0 0 0 0 0 0
3 0 0 0 0 0 0 0 0
4 0 0 0 0 0 0 0 0
5 0 0 0 0 0 0 0 0
6 0 0 0 0 0 0 0 0
7 0 0 0 0 0 0 0 0
8 0 0 0 0 0 0 0 0
9 0 0 0 0 0 0 0 0
10 0 0 0 0 0 0 0 0

Figure 7 - 19. Authenticator Statistics window

The user may also select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

The following fields can be viewed:

Parameter	Description
Port	The identification number assigned to the Port by the System in which the Port resides.
Frames Rx	The number of valid EAPOL frames that have been received by this Authenticator.
Frames Tx	The number of EAPOL frames that have been transmitted by this Authenticator.
Rx Start	The number of EAPOL Start frames that have been received by this Authenticator.
TxReqId	The number of EAP Req/Id frames that have been transmitted by this Authenticator.
RxLogOff	The number of EAPOL Logoff frames that have been received by this Authenticator.

Tx Req	The number of EAP Request frames (other than Rq/Id frames) that have been transmitted by this Authenticator.
Rx RespId	The number of EAP Resp/Id frames that have been received by this Authenticator.
Rx Resp	The number of valid EAP Response frames (other than Resp/Id frames) that have been received by this Authenticator.
Rx Invalid	The number of EAPOL frames that have been received by this Authenticator in which the frame type is not recognized.
Rx Error	The number of EAPOL frames that have been received by this Authenticator in which the Packet Body Length field is invalid.
Last Version	The protocol version number carried in the most recently received EAPOL frame.
Last Source	The source MAC address carried in the most recently received EAPOL frame.

Authenticator Session Statistics

Users can display session statistics objects for the Authenticator PAE associated with each port. An entry appears in this table for each port that supports the Authenticator function.

To view the following window, click **Monitoring > Port Access Control > Authenticator Session Statistics**:

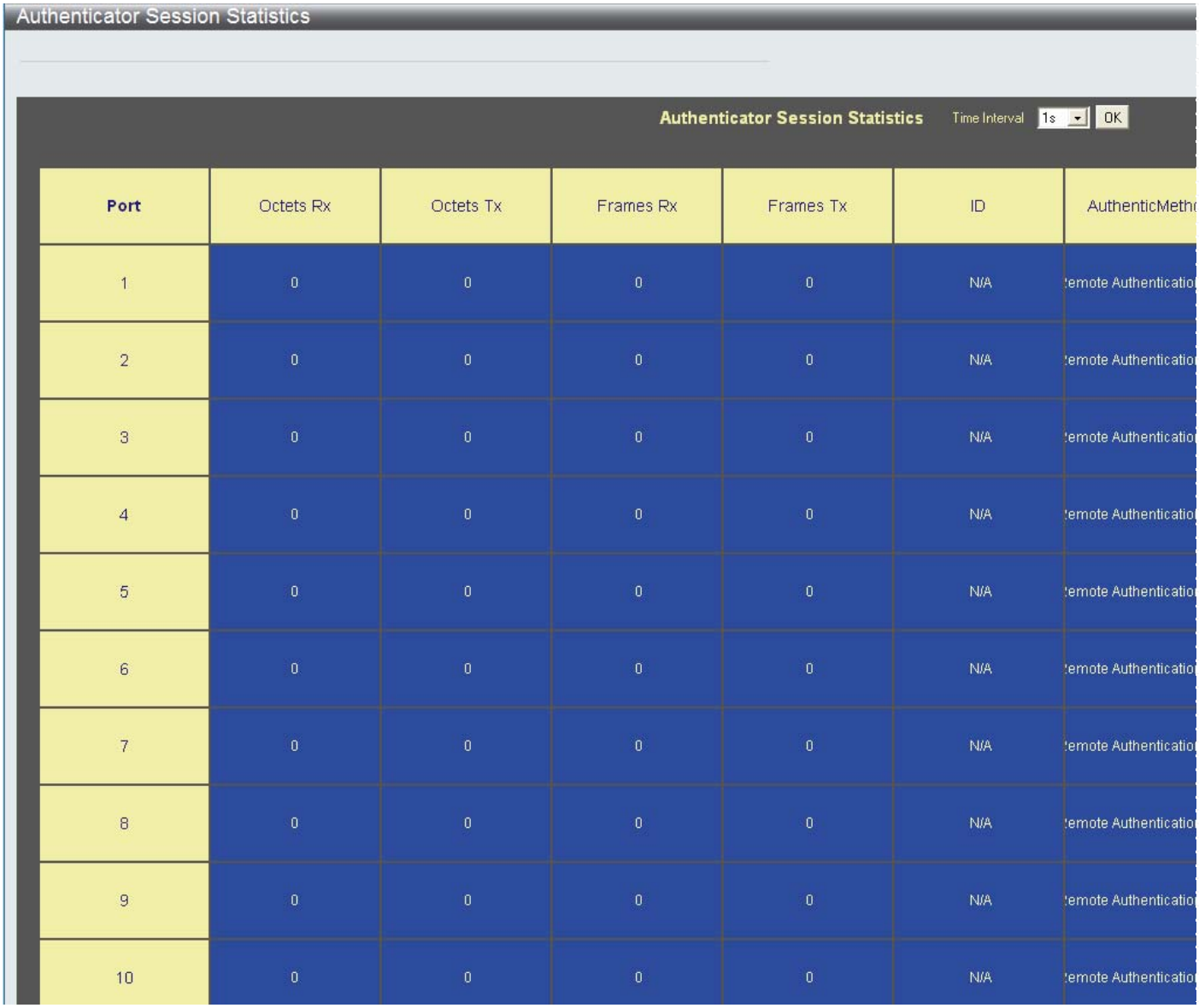


Figure 7 - 20. Authenticator Session Statistics window

The user may select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

The following fields can be viewed:

Parameter	Description
Port	The identification number assigned to the Port by the System in which the Port resides.
Octets Rx	The number of octets received in user data frames on this port during the session.
Octets Tx	The number of octets transmitted in user data frames on this port during the session.
Frames Rx	The number of user data frames received on this port during the session.

Frames Tx	The number of user data frames transmitted on this port during the session.
ID	A unique identifier for the session, in the form of a printable ASCII string of at least three characters.
Authentic Method	The authentication method used to establish the session. Valid Authentic Methods include: (1) Remote Authentic Server - The Authentication Server is external to the Authenticator's System. (2) Local Authentic Server - The Authentication Server is located within the Authenticator's System.
Time	The duration of the session in seconds.
Terminate Cause	The reason for the session termination. There are eight possible reasons for termination. 1) Supplicant Logoff 2) Port Failure 3) Supplicant Restart 4) Reauthentication Failure 5) AuthControlledPortControl set to ForceUnauthorized 6) Port re-initialization 7) Port Administratively Disabled 8) Not Terminated Yet
UserName	The User-Name representing the identity of the Supplicant PAE.

Authenticator Diagnostics

Users can display diagnostic information regarding the operation of the Authenticator associated with each port. An entry appears in this table for each port that supports the Authenticator function.

To view the following window, click **Monitoring > Port Access Control > Authenticator Diagnostics**:

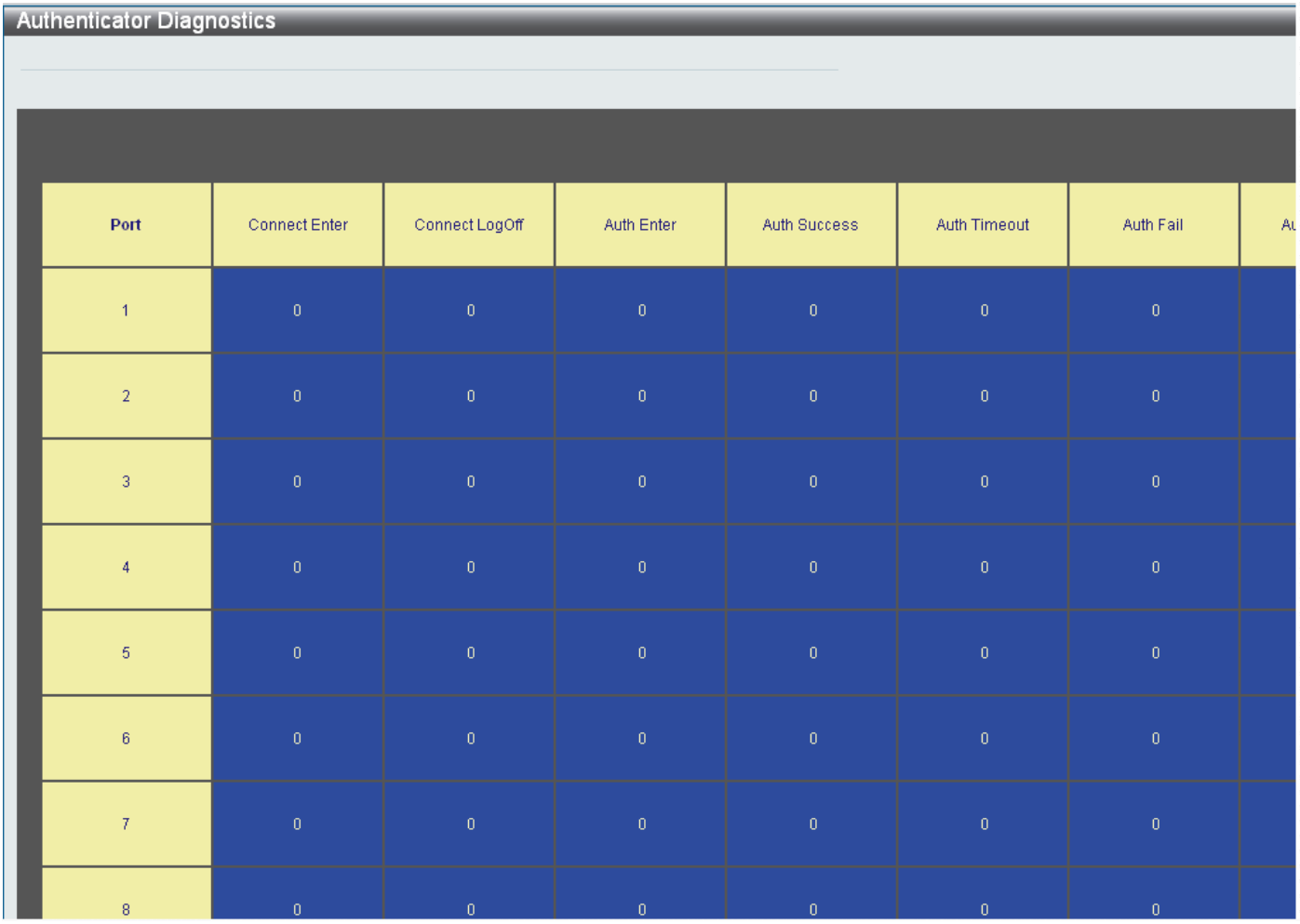

Authenticator Diagnostics
Port
Connect Enter
Connect LogOff
Auth Enter
Auth Success
Auth Timeout
Auth Fail
1 0 0 0 0 0 0
2 0 0 0 0 0 0
3 0 0 0 0 0 0
4 0 0 0 0 0 0
5 0 0 0 0 0 0
6 0 0 0 0 0 0
7 0 0 0 0 0 0
8 0 0 0 0 0 0

Figure 7 - 21. Authenticator Diagnostics window

The user may select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

The following fields can be viewed:

Parameter	Description
Port	The identification number assigned to the Port by the System in which the Port resides.
Connect Enter	Counts the number of times that the state machine transitions to the CONNECTING state from any other state.
Connect LogOff	Counts the number of times that the state machine transitions from CONNECTING to DISCONNECTED as a result of receiving an EAPOL-Logoff message.
Auth Enter	Counts the number of times that the state machine transitions from CONNECTING to AUTHENTICATING, as a result of an EAP-Response/Identity message being received from the Supplicant.
Auth Success	Counts the number of times that the state machine transitions from AUTHENTICATING to AUTHENTICATED, as a result of the Backend Authentication state machine indicating

	successful authentication of the Supplicant (authSuccess = TRUE).
Auth Timeout	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of the Backend Authentication state machine indicating authentication timeout (authTimeout = TRUE).
Auth Fail	Counts the number of times that the state machine transitions from AUTHENTICATING to HELD, as a result of the Backend Authentication state machine indicating authentication failure (authFail = TRUE).
Auth Reauth	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of a reauthentication request (reAuthenticate = TRUE).
Auth Start	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of an EAPOL-Start message being received from the Supplicant.
Auth LogOff	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of an EAPOL-Logoff message being received from the Supplicant.
Authed Reauth	Counts the number of times that the state machine transitions from AUTHENTICATED to CONNECTING, as a result of a reauthentication request (reAuthenticate = TRUE).
Authed Start	Counts the number of times that the state machine transitions from AUTHENTICATED to CONNECTING, as a result of an EAPOL-Start message being received from the Supplicant.
Authed LogOff	Counts the number of times that the state machine transitions from AUTHENTICATED to DISCONNECTED, as a result of an EAPOL-Logoff message being received from the Supplicant.
Responses	Counts the number of times that the state machine sends an initial Access-Request packet to the Authentication server (i.e., executes sendRespToServer on entry to the RESPONSE state). Indicates that the Authenticator attempted communication with the Authentication Server.
AccessChallenges	Counts the number of times that the state machine receives an initial Access-Challenge packet from the Authentication server (i.e., aReq becomes TRUE, causing exit from the RESPONSE state). Indicates that the Authentication Server has communication with the Authenticator.
OtherReqToSupp	Counts the number of times that the state machine sends an EAP-Request packet (other than an Identity, Notification, Failure, or Success message) to the Supplicant (i.e., executes txReq on entry to the REQUEST state). Indicates that the Authenticator chose an EAP-method.
NonNakRespFromSup	Counts the number of times that the state machine receives a response from the Supplicant to an initial EAP-Request, and the response is something other than EAP-NAK (i.e., rxResp becomes TRUE, causing the state machine to transition from REQUEST to RESPONSE, and the response is not an EAP-NAK). Indicates that the Supplicant can respond to the Authenticator's chosen EAP-method.
Bac Auth Success	Counts the number of times that the state machine receives an Accept message from the Authentication Server (i.e., aSuccess becomes TRUE, causing a transition from RESPONSE to SUCCESS). Indicates that the Supplicant has successfully authenticated to the Authentication Server.
Bac Auth Fail	Counts the number of times that the state machine receives a Reject message from the Authentication Server (i.e., aFail becomes TRUE, causing a transition from RESPONSE to FAIL). Indicates that the Supplicant has not authenticated to the Authentication Server.

RADIUS Authentication

Users can display information concerning the activity of the RADIUS authentication client on the client side of the RADIUS authentication protocol.

To view the following window, click **Monitoring > Port Access Control > RADIUS Authentication**:

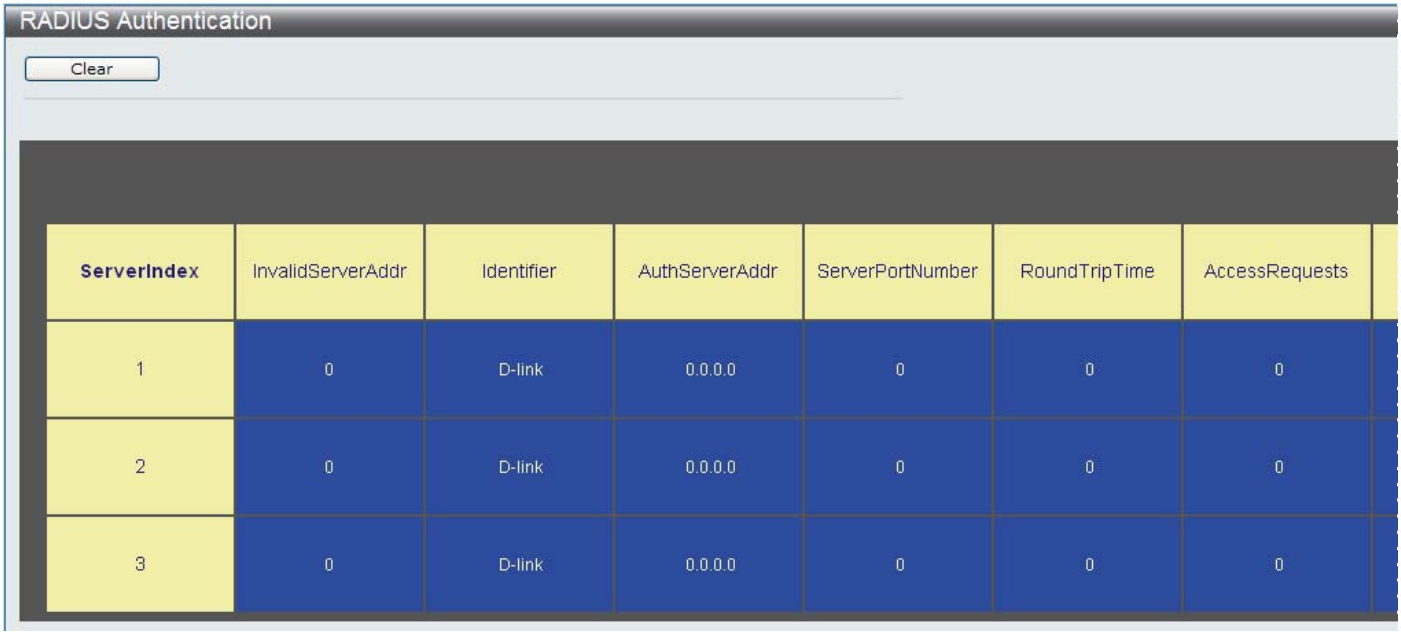


Figure 7 - 22. RADIUS Authentication window

The user may also select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second. To clear the current statistics shown, click the *Clear* button in the top left hand corner.

The following information is displayed:

Parameter	Description
InvalidServerAddresses	The number of RADIUS Access-Response packets received from unknown addresses.
Identifier	The NAS-Identifier of the RADIUS authentication client. (This is not necessarily the same as sysName in MIB II.)
ServerIndex	The identification number assigned to each RADIUS Authentication server that the client shares a secret with.
AuthServerAddress	The (conceptual) table listing the RADIUS authentication servers with which the client shares a secret.
ServerPortNumber	The UDP port the client is using to send requests to this server.
RoundTripTime	The time interval (in hundredths of a second) between the most recent Access-Reply/Access-Challenge and the Access-Request that matched it from this RADIUS authentication server.
AccessRequests	The number of RADIUS Access-Request packets sent to this server. This does not include retransmissions.
AccessRetransmissions	The number of RADIUS Access-Request packets retransmitted to this RADIUS authentication server.
AccessAccepts	The number of RADIUS Access-Accept packets (valid or invalid) received from this server.
AccessRejects	The number of RADIUS Access-Reject packets (valid or invalid) received from this server.
AccessChallenges	The number of RADIUS Access-Challenge packets (valid or invalid) received from this

	server.
AccessResponses	The number of malformed RADIUS Access-Response packets received from this server. Malformed packets include packets with an invalid length. Bad authenticators or Signature attributes or known types are not included as malformed access responses.
BadAuthenticators	The number of RADIUS Access-Response packets containing invalid authenticators or Signature attributes received from this server.
PendingRequests	The number of RADIUS Access-Request packets destined for this server that have not yet timed out or received a response. This variable is incremented when an Access-Request is sent and decremented due to receipt of an Access-Accept, Access-Reject or Access-Challenge, a timeout or retransmission.
Timeouts	The number of authentication timeouts to this server. After a timeout the client may retry to the same server, send to a different server, or give up. A retry to the same server is counted as a retransmit as well as a timeout. A send to a different server is counted as a Request as well as a timeout.
UnknownTypes	The number of RADIUS packets of unknown type which were received from this server on the authentication port
PacketsDropped	The number of RADIUS packets of which were received from this server on the authentication port and dropped for some other reason.

RADIUS Account Client

Users can display managed objects used for managing RADIUS accounting clients, and the current statistics associated with them.

To view the following window, click **Monitoring > Port Access Control > RADIUS Account Client**:

Figure 7 - 23. RADIUS Account Client window

The user may also select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second. To clear the current statistics shown, click the *Clear* button in the top left hand corner.

The following information is displayed:

Parameter	Description
ServerIndex	The identification number assigned to each RADIUS Accounting server that the client shares a secret with.
InvalidServerAddr	The number of RADIUS Accounting-Response packets received from unknown

	addresses.
Identifier	The NAS-Identifier of the RADIUS accounting client. (This is not necessarily the same as sysName in MIB II.)
ServerAddr	The (conceptual) table listing the RADIUS accounting servers with which the client shares a secret.
ServerPortNumber	The UDP port the client is using to send requests to this server.
RoundTripTime	The time interval between the most recent Accounting-Response and the Accounting-Request that matched it from this RADIUS accounting server.
Requests	The number of RADIUS Accounting-Request packets sent. This does not include retransmissions.
Retransmissions	The number of RADIUS Accounting-Request packets retransmitted to this RADIUS accounting server. Retransmissions include retries where the Identifier and Acct-Delay have been updated, as well as those in which they remain the same.
Responses	The number of RADIUS packets received on the accounting port from this server.
MalformedResponses	The number of malformed RADIUS Accounting-Response packets received from this server. Malformed packets include packets with an invalid length. Bad authenticators and unknown types are not included as malformed accounting responses.
BadAuthenticators	The number of RADIUS Accounting-Response packets, which contained invalid authenticators, received from this server.
PendingRequests	The number of RADIUS Accounting-Request packets sent to this server that have not yet timed out or received a response. This variable is incremented when an Accounting-Request is sent and decremented due to receipt of an Accounting-Response, a timeout or a retransmission.
Timeouts	The number of accounting timeouts to this server. After a timeout the client may retry to the same server, send to a different server, or give up. A retry to the same server is counted as a retransmit as well as a timeout. A send to a different server is counted as an Accounting-Request as well as a timeout.
UnknownTypes	The number of RADIUS packets of unknown type which were received from this server on the accounting port.
PacketsDropped	The number of RADIUS packets, which were received from this server on the accounting port and dropped for some other reason.

Browse ARP Table

Users can display current ARP entries on the Switch. To search a specific ARP entry, enter an Interface Name or an IP Address at the top of the window and click **Find**. Click the **Show Static** button to display static ARP table entries. To clear the ARP Table, click **Clear All**.

To view the following window, click **Monitoring** > **Browse ARP Table**:

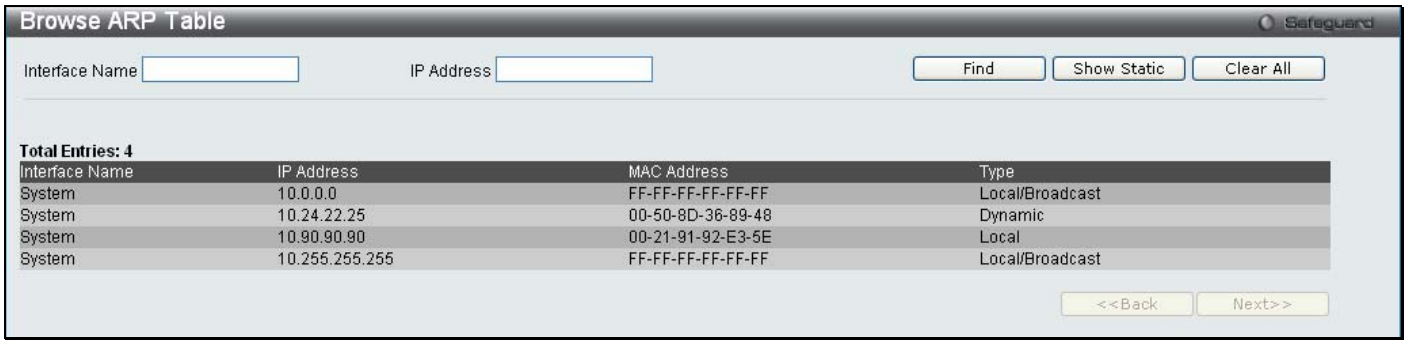


Figure 7 - 24. Browse ARP Table window

Browse VLAN

Users can display the VLAN status for each of the Switch's ports viewed by VLAN. Enter a VID (VLAN ID) in the field at the top of the window and click the **Find** button.

To view the following window, click **Monitoring** > **Browse VLAN**:

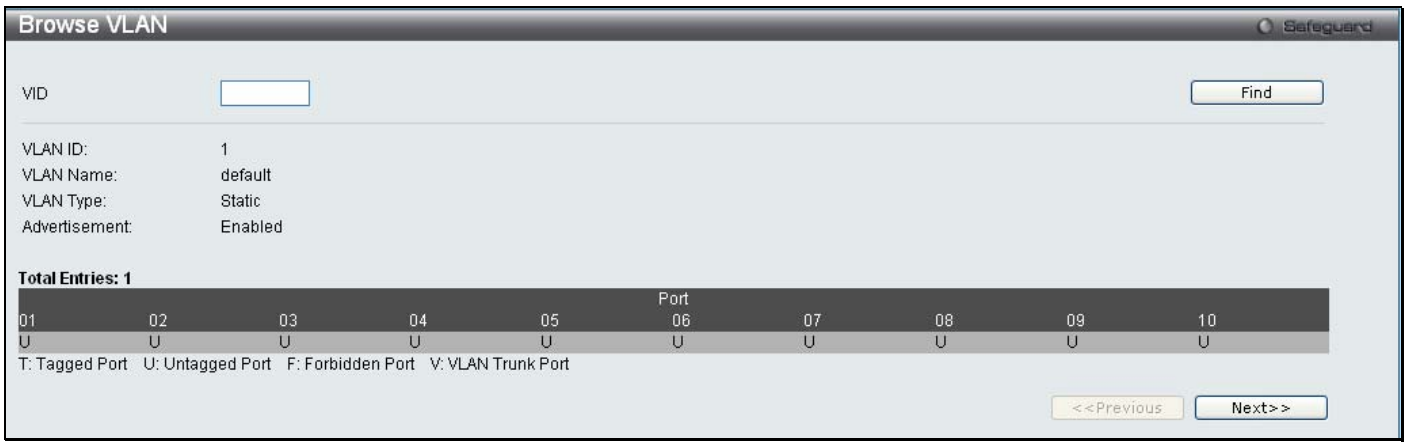


Figure 7 - 25. Browse VLAN window

Browse Router Port

Users can display which of the Switch's ports are currently configured as router ports. A router port configured by a user (using the console or Web-based management interfaces) is displayed as a static router port, designated by S. A router port that is dynamically configured by the Switch is designated by D, while a Forbidden port is designated by F.

To view the following window, click **Monitoring** > **Browse Router Port**:

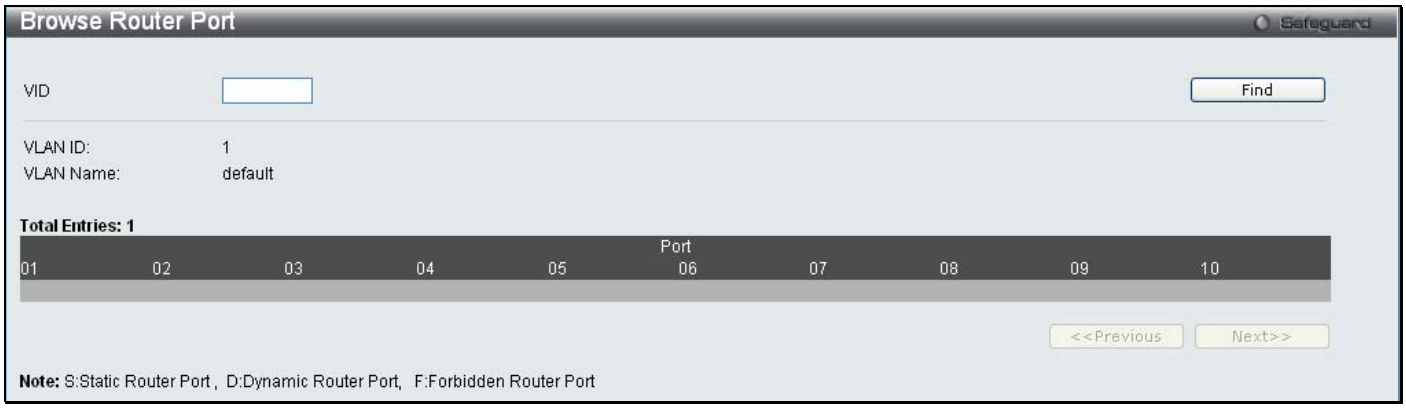


Figure 7 - 26. Browse Router Port window

Enter a VID (VLAN ID) in the field at the top of the window and click the **Find** button.

Browse MLD Router Port

Users can display which of the Switch's ports are currently configured as router ports in IPv6. A router port configured by a user (using the console or Web-based management interfaces) is displayed as a static router port, designated by S. A router port that is dynamically configured by the Switch is designated by D, while a Forbidden port is designated by F..

To view the following window, click **Monitoring** > **Browse MLD Router Port**:

Figure 7 - 27. Browse MLD Router Port window

Enter a VID (VLAN ID) in the field at the top of the window and click the **Find** button.

Browse Session Table

Users can display the management sessions since the Switch was last rebooted.

To view the following window, click **Monitoring** > **Browse Session Table**:

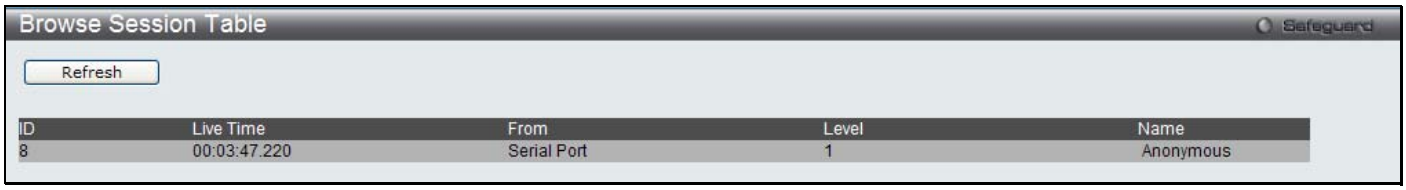


Figure 7 - 28. Browse Session Table window

IGMP Snooping Group

Users can view the Switch's IGMP Snooping Group Table. IGMP Snooping allows the Switch to read the Multicast Group IP address and the corresponding MAC address from IGMP packets that pass through the Switch.

To view the following window, click **Monitoring** > **IGMP Snooping Group**:

Figure 7 - 29. IGMP Snooping Group window

The user may search the IGMP Snooping Group Table by either *VLAN Name* or *VID List* by entering it in the top left hand corner and clicking **Find**.

The following fields and settings can be viewed:

Parameter	Description
VID List/VLAN Name	The *VID List* or *VLAN Name* of the multicast group.
VID/VLAN Name	The *VID* or *VLAN Name* of the multicast group.
IP Address	Enter the IP address.
Delete	Click this button to delete the designated IGMP snooping groups learned by the Data Driven feature.
Delete All	Click this button to delete all the IGMP snooping groups learned by the Data Driven feature.

NOTE: To configure IGMP snooping for the Switch, go to the **L2 Features** folder and select **IGMP Snooping** > **IGMP Snooping Settings**.

MLD Snooping Group

Users can view MLD Snooping Groups present on the Switch. MLD Snooping is an IPv6 function comparable to IGMP Snooping for IPv4.

To view the following window, click **Monitoring** > **MLD Snooping Group**:

Figure 7 - 30. MLD Snooping Group window

The user may browse this table by either VLAN Name or VID List present in the Switch by entering that VLAN Name/VID List in the empty field shown below, and clicking the **Find** button.

The following fields and settings can be viewed:

Parameter	Description
VID List/VLAN Name	The *VID List* or *VLAN Name* of the multicast group.
Source	The source MAC address of the multicast group.
Group	The multicast group.
Port Member	The port members of this group.
Mode	The mode in current use.

NOTE: To configure MLD snooping for the Switch, go to the **L2 Features** folder and select **MLD Snooping** > **MLD Snooping Settings**.

WAC Authenticating State

Users can display the current WAC authentication state and delete WAC authentication state settings.

To view the following window, click **Monitoring** > **WAC Authenticating State**:

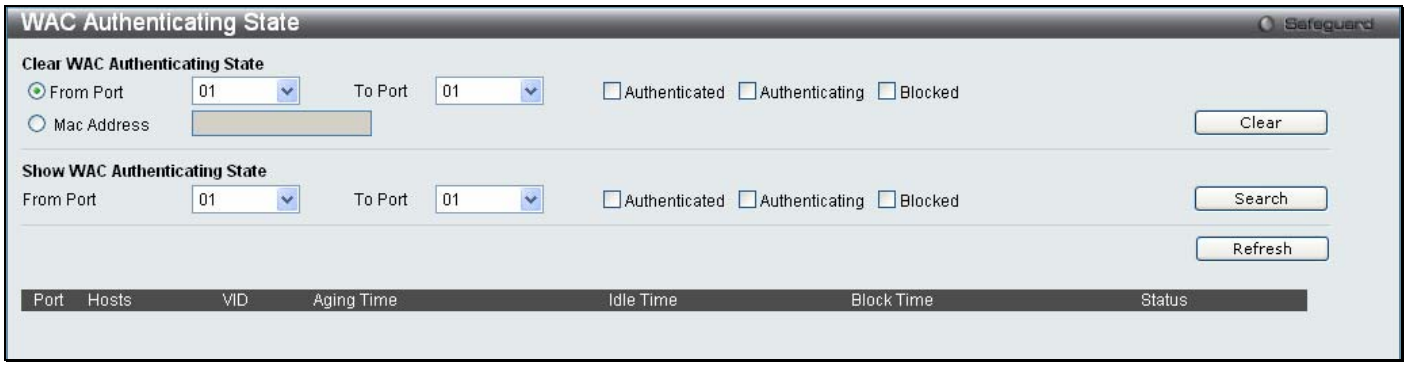


Figure 7 - 31. WAC Authenticating State window

The following fields and settings can be viewed:

Parameter	Description
From Port/To Port	Use the drop-down menus to select the desired range of ports and tick the appropriate check box(es), Authenticated, Authenticating, and Blocked.
MAC Address	Enter the MAC address for the device whose WAC authenticating state will be removed.
Search	Click this button to initiate a search.
Clear	Click this button to delete the WAC authentication state information seleted above.
Refresh	Click this button to refresh the values on this window.
Authenticated	Tick this check box to display all authenticated users for a port.
Authenticating	Tick this check box to display all authenticating users for a port.
Blocked	Tick this check box to display all blocked users for a port.

JWAC Host Table

Users can display Japanese Web-based Access Control Host Table information.

To view the following window, click **Monitoring** > **JWAC Host Table**:

Figure 7 - 32. JWAC Host Table window

The following fields and settings can be viewed:

Parameter	Description
Port List	Enter a port or range of ports.
Find	Click this button to initiate the search function.
Clear	Click this button to delete the Port List data at the top of the window.
View All Hosts	Click this button to view all the JWAC hosts.
Clear All Hosts	Click this button to delete all the JWAC hosts.
Authenticated	Tick this check box to only show authenticated client hosts.
Authenticating	Tick this check box to only show client hosts in the authenticating process.
Blocked	Tick this check box to only show client hosts being temporarily blocked because of the failure of authentication.

MAC Address Table

This allows the Switch's dynamic MAC address forwarding table to be viewed. When the Switch learns an association between a MAC address and a port number, it makes an entry into its forwarding table. These entries are then used to forward packets through the Switch.

To view the following window, click **Monitoring** > **MAC Address Table**:

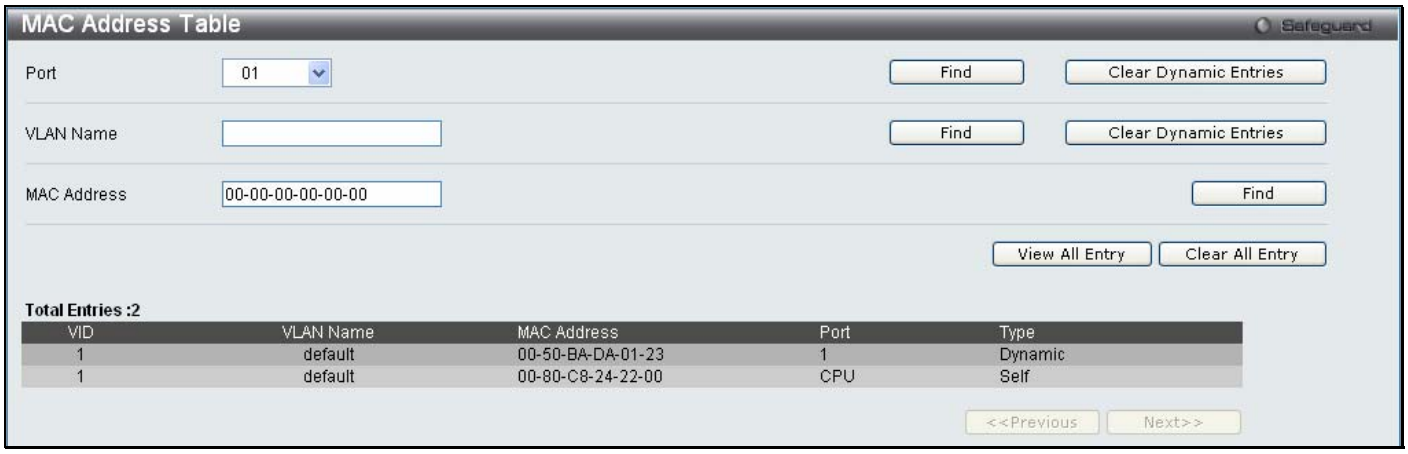


Figure 7 - 33. MAC Address Table window

The functions used in the MAC address table are described below:

Parameter	Description
Port	The port to which the MAC address below corresponds.
VLAN Name	Enter a VLAN Name for the forwarding table to be browsed by.
MAC Address	Enter a MAC address for the forwarding table to be browsed by.
Find	Allows the user to move to a sector of the database corresponding to a user defined port, VLAN, or MAC address.
Clear Dynamic Entries	Clicking this button will allow the user to delete all dynamic entries of the address table.
View All Entry	Clicking this button will allow the user to view all entries of the address table.
Clear All Entry	Clicking this button will allow the user to delete all entries of the address table.

System Log

Users can view the history log as compiled by the Switch's management agent.

To view the following window, click **Monitoring** > **System Log**:

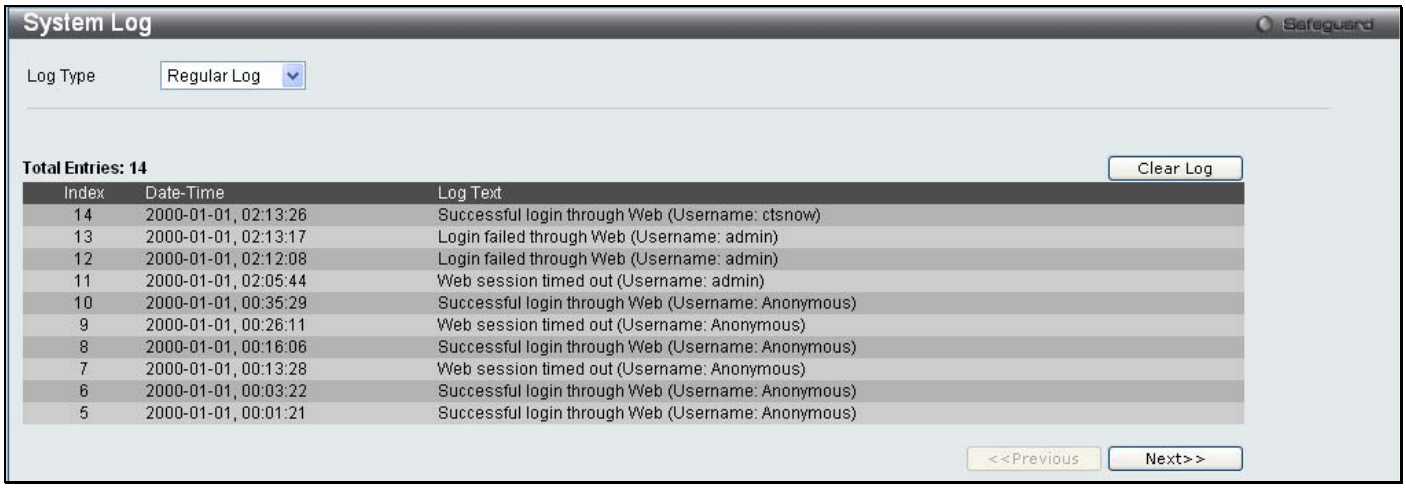

System Log
Safeguard
Log Type
Regular Log
Total Entries: 14
Clear Log
Index
Date-Time
Log Text
14 2000-01-01, 02:13:26 Successful login through Web (Username: ctsnow)
13 2000-01-01, 02:13:17 Login failed through Web (Username: admin)
12 2000-01-01, 02:12:08 Login failed through Web (Username: admin)
11 2000-01-01, 02:05:44 Web session timed out (Username: admin)
10 2000-01-01, 00:35:29 Successful login through Web (Username: Anonymous)
9 2000-01-01, 00:26:11 Web session timed out (Username: Anonymous)
8 2000-01-01, 00:16:06 Successful login through Web (Username: Anonymous)
7 2000-01-01, 00:13:28 Web session timed out (Username: Anonymous)
6 2000-01-01, 00:03:22 Successful login through Web (Username: Anonymous)
5 2000-01-01, 00:01:21 Successful login through Web (Username: Anonymous)
<<Previous
Next>>

Figure 7 - 34. System Log window

The Switch can record event information in its own logs, to designated SNMP trap receiving stations, and to the PC connected to the console manager. Click **Next** to go to the next page of the **System Log** window. Clicking **Clear** will allow the user to clear the Switch History Log.

The information in the table is categorized as:

Parameter	Description
Type	Choose the type of log to view. There are two choices: *Regular Log* – Choose this option to view regular switch log entries, such as logins or firmware transfers. *Attack Log* – Choose this option to view attack log files, such as spoofing attacks.
Index	A counter incremented whenever an entry to the Switch's history log is made. The table displays the last entry (highest sequence number) first.
Date-Time	Displays the time in days, hours, minutes, and seconds since the Switch was last restarted.
Log Text	Displays text describing the event that triggered the history log entry.

MAC-based Access Control Authentication State

Users can display MAC-based Access Control Authentication State information.

To view the following window, click **Monitoring** > **MAC-based Access Control Authentication State**:

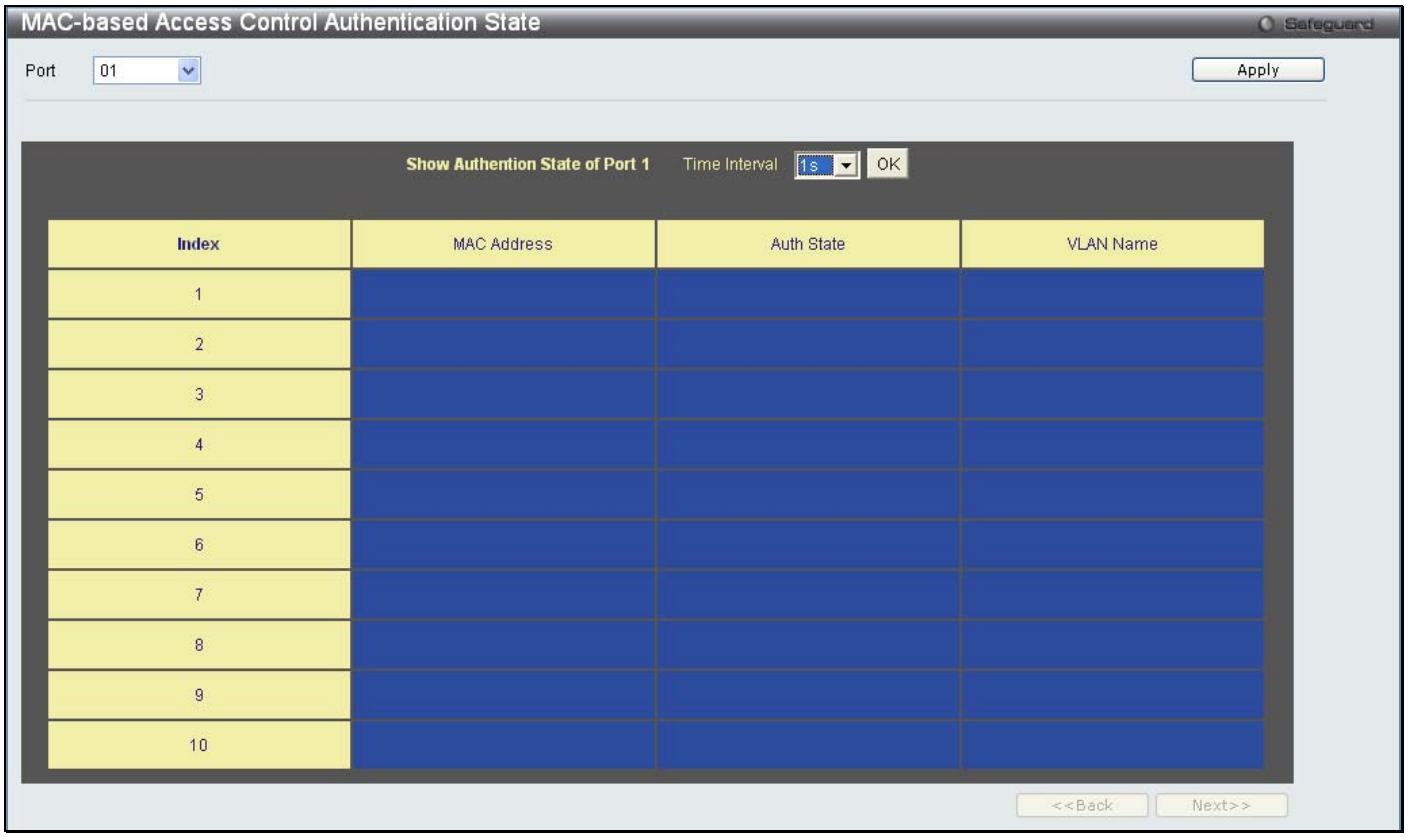


Figure 7 - 35. MAC-based Access Control Authentication State window

To display MAC-based Access Control Authentication State information, select a port using the Port drop-down menu and then click **Apply**. Users may also want to adjust the Time Interval at the top of the window.

Section 8

Save Services and Tools

Save Configuration ID 1

Save Configuration ID 2

Save Log

Save All

Configuration File Backup & Restore

Upload Log File

Reset

Download Firmware

Reboot System

The four **Save** windows include: **Save Configuration 1**, **Save Configuration 2**, **Save Log**, and **Save All**. Each version of the window will aid the user in saving configurations to the Switch's memory.

The options include:

- **Save Configuration_ID_1** to save the configuration file indexed as Image file 1. To use this file for configuration it must be designated as the *Boot* configuration.
- **Save Configuration_ID_2** to save the configuration file indexed as Image file 2. To use this file for configuration it must be designated as the *Boot* configuration.
- **Save Log** to save only the current log.
- **Save All** to save the current configuration file indexed as Image file 1 and save the current log.

Save Configuration ID 1

Open the **Save** drop-down menu at the top of the Web manager and click **Save Configuration ID 1** to open the following window:

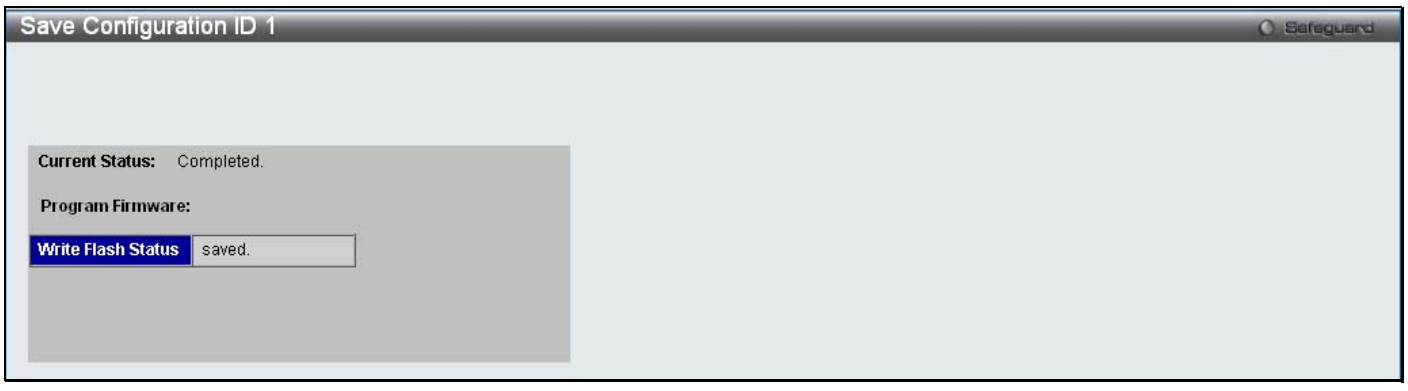


Figure 8 - 1. Save Configuration ID 1 window

Save Configuration ID 2

Open the **Save** drop-down menu at the top of the Web manager and click **Save Configuration ID 2** to open the following window:

Figure 8 - 2. Save Configuration ID 2 window

Save Log

Open the **Save** drop-down menu at the top of the Web manager and click **Save Log** to open the following window:

Figure 8 - 3. Save Log window

Save All

Open the **Save** drop-down menu at the top of the Web manager and click **Save All** to open the following window:

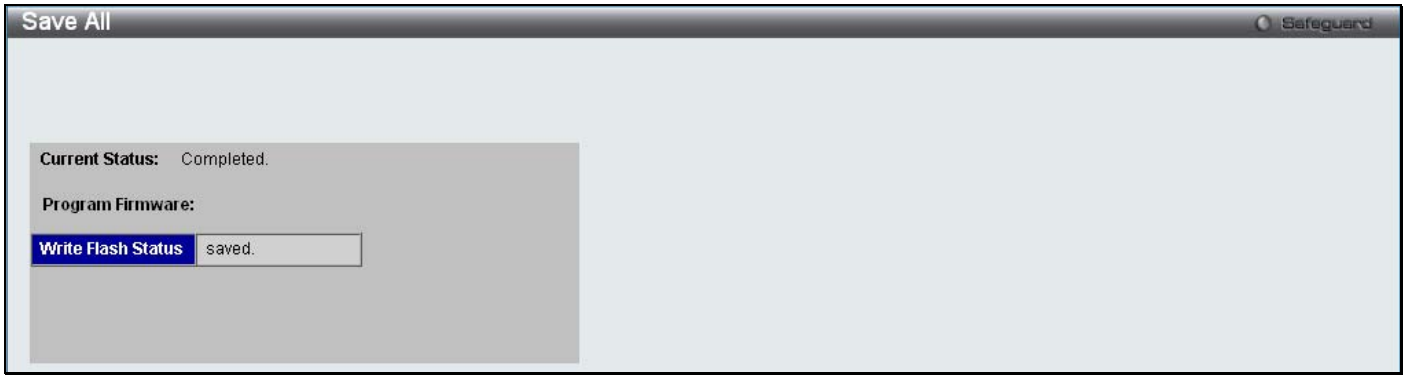


Figure 8 - 4. Save All window

Configuration File Backup & Restore

The Switch supports dual image storage for configuration file backup and restoration. The firmware and configuration images are indexed by ID number 1 or 2. To change the boot firmware image, use the Configuration ID drop-down menu to select the desired configuration file to backup or restore. The default Switch settings will use image ID 1 as the boot configuration or firmware.

To backup the configuration file, enter the Server IP, file/path name, desired Configuration ID, and click **Backup**.

To restore the configuration file, enter the Server IP, file/path name, desired Configuration ID, and click **Restore**.

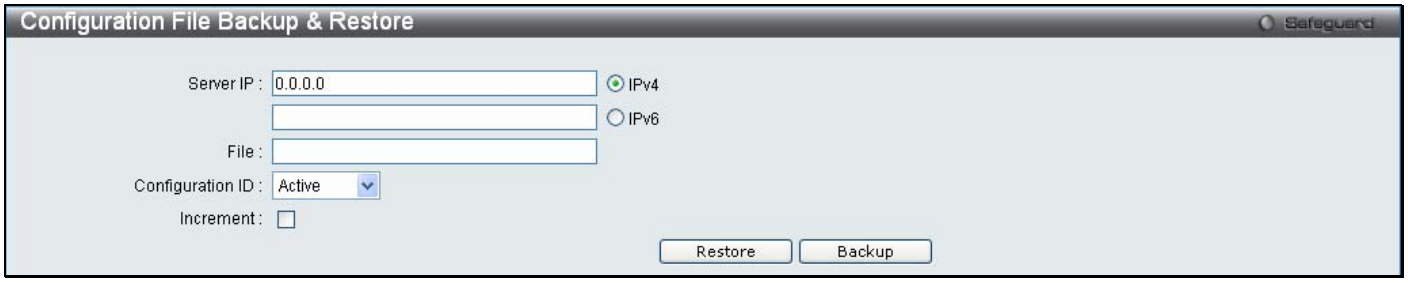


Figure 8 - 5. Configuration File Backup & Restore window

Upload Log File

A history and attack log can be uploaded from the Switch to a TFTP server. To upload a log file, enter a Server IP address and file/path name. Select either IPv4 or IPv6 and then click **Upload** or **Upload Attack Log**.

Figure 8 - 6. Upload Log File window

Reset

The Reset function has several options when resetting the Switch. Some of the current configuration parameters can be retained while resetting all other configuration parameters to their factory defaults.

NOTE: Only the Reset System option will enter the factory default parameters into the Switch's non-volatile RAM, and then restart the Switch. All other options enter the factory defaults into the current configuration, but do not save this configuration. Reset System will return the Switch's configuration to the state it was when it left the factory

Reset gives the option of retaining the Switch's User Accounts and History Log while resetting all other configuration parameters to their factory defaults. If the Switch is reset using this window, and **Save Changes** is not executed, the Switch will return to the last saved configuration when rebooted.

Reset System
Safeguard
Reset
Proceed with system reset except IP address, log, user account and banner.
Reset Config
Switch will be reset to factory defaults.
Reset System
Switch will be reset to factory defaults and reboot.
Apply

Figure 8 - 7. Reset System window

Download Firmware

The following window is used to download firmware for the Switch.

Figure 8 - 8. Download Firmware window

Enter the Server IP address in the first field and and specify the path/file name of the firmware in the third field. Select either IPv4 or IPv6. Select the desired Image ID, *Active*, *1* or *2*. Click **Download** to initiate the file transfer.

Reboot System

The following window is used to restart the Switch.

Reboot System
Safeguard
Do you want to save the settings ?
Yes
No
Reboot
If you do not save the settings, all changes made in this session will be lost.

Figure 8 - 9. Reboot System window

Clicking the Yes radio button will instruct the Switch to save the current configuration to non-volatile RAM before restarting the Switch.

Clicking the No radio button instructs the Switch not to save the current configuration before restarting the Switch. All of the configuration information entered from the last time **Save Changes** was executed will be lost.

Click the **Reboot** button to restart the Switch.

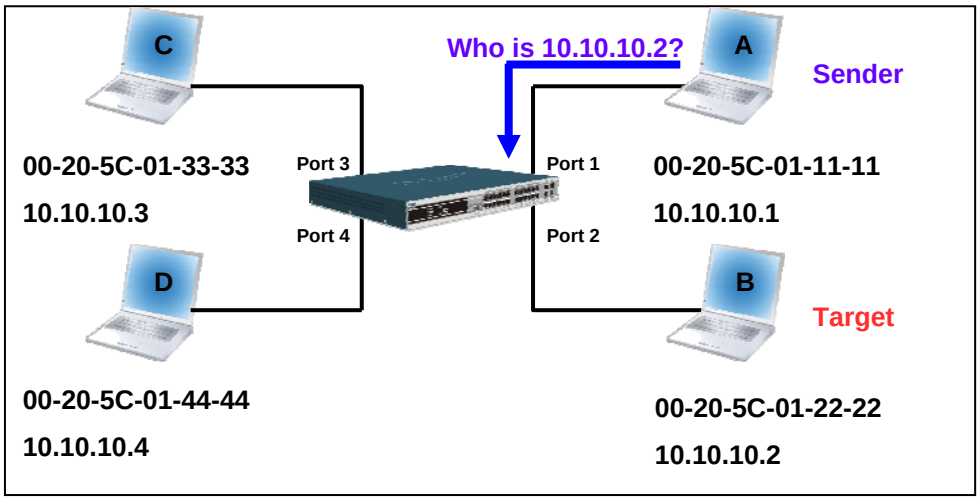
Appendix A – Mitigating ARP Spoofing Attacks Using Packet Content ACL

How Address Resolution Protocol works

Address Resolution Protocol (ARP) is the standard method for finding a host's hardware address (MAC address) when only its IP address is known. However, this protocol is vulnerable because crackers can spoof the IP and MAC information in the ARP packets to attack a LAN (known as ARP spoofing). This document is intended to introduce the ARP protocol, ARP spoofing attacks, and the countermeasures brought by D-Link's switches to thwart ARP spoofing attacks.

In the process of ARP, PC A will first issue an ARP request to query PC B's MAC address. The network structure is shown in Figure 1.

Figure 1



In the meantime, PC A's MAC address will be written into the "Sender H/W Address" and its IP address will be written into the "Sender Protocol Address" in the ARP payload. As PC B's MAC address is unknown, the "Target H/W Address" will be "00-00-00-00-00-00," while PC B's IP address will be written into the "Target Protocol Address," shown in Table1.

Table 1. ARP Payload

H/W Type	Protocol Type	H/W Address Length	Protocol Address Length	Operation	Sender H/W Address	Sender Protocol Address	Target H/W Address	Target Protocol Address
				ARP request	*00-20-5C-01-11-11*	*10.10.10.1*	*00-00-00-00-00-00*	*10.10.10.2*

The ARP request will be encapsulated into an Ethernet frame and sent out. As can be seen in Table 2, the "Source Address" in the Ethernet frame will be PC A's MAC address. Since an ARP request is sent via broadcast, the "Destination address" is in a format of Ethernet broadcast (FF-FF-FF-FF-FF-FF).

Table 2. Ethernet Frame Format

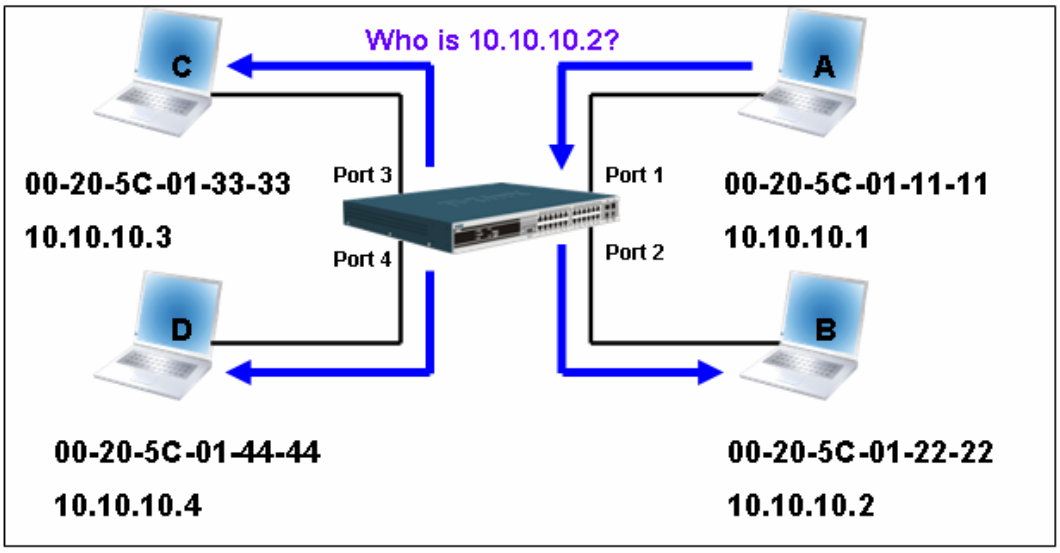
Destination Address	Source Address	Ether-Type	ARP	FCS
FF-FF-FF-FF-FF-FF	*00-20-5C-01-11-11*			

When the switch receives the frame, it will check the "Source Address" in the Ethernet frame's header. If the address is not in its Forwarding Table, the switch will learn PC A's MAC and the associated port into its Forwarding Table.

Forwarding Table	
Port 1	00-20-5C-01-11-11

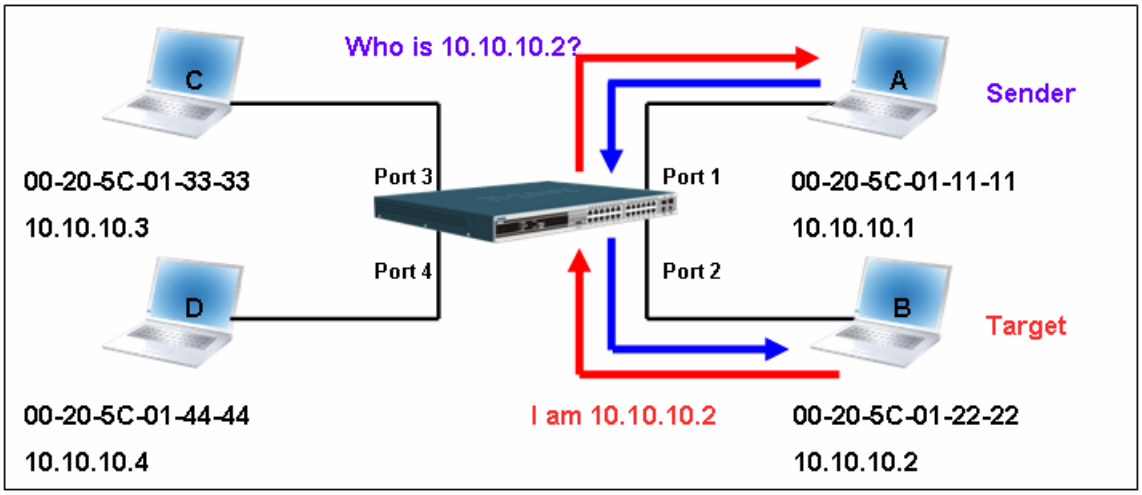
In addition, when the switch receives the broadcasted ARP request, it will flood the frame to all ports except the source port, port 1 (see Figure 2).

Figure 2



When the switch floods the frame of ARP request to the network, all PCs will receive and examine the frame but only PC B will reply the query as the destination IP matched (see Figure 3).

Figure 3



When PC B replies to the ARP request, its MAC address will be written into "Target H/W Address" in the ARP payload shown in Table 3. The ARP reply will be then encapsulated into an Ethernet frame again and sent back to the sender. The ARP reply is in a form of Unicast communication.

Table 3. ARP Payload

H/W Type	Protocol Type	H/W Address Length	Protocol Address Length	Operation	Sender H/W Address	Sender Protocol Address	Target H/W Address	Target Protocol Address
				ARP reply	***00-20-5C-01-11-11***	***10.10.10.1***	***00-00-00-00-00-00***	***10.10.10.2***

When PC B replies to the query, the "Destination Address" in the Ethernet frame will be changed to PC A's MAC address. The "Source Address" will be changed to PC B's MAC address (see Table 4).

Table 4. Ethernet Frame Format

Destination Address	Source Address	Ether-Type	ARP	FCS
00-20-5C-01-11-11	***00-20-5C-01-22-22***			

The switch will also examine the “Source Address” of the Ethernet frame and find that the address is not in the Forwarding Table. The switch will learn PC B’s MAC and update its Forwarding Table.

Forwarding Table

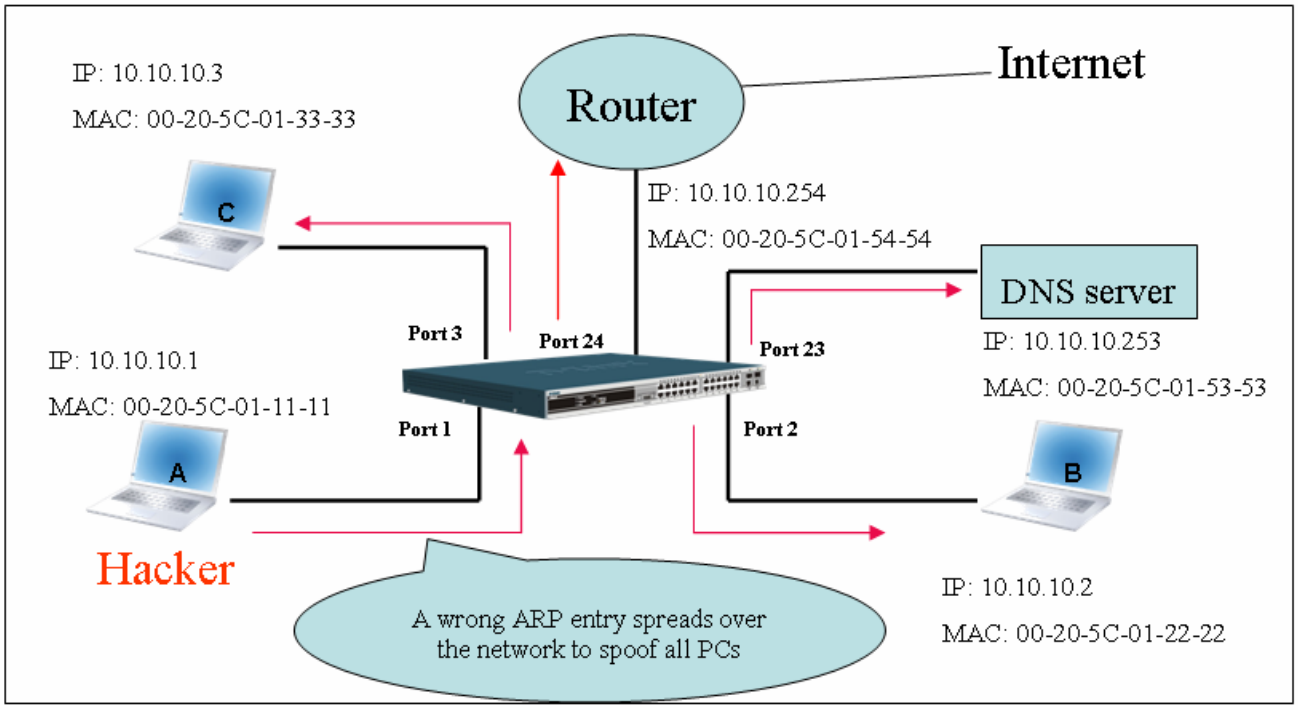
Port1	**00-20-5C-01-11-11**
Port2	**00-20-5C-01-22-22**

How ARP Spoofing Attacks a Network

ARP spoofing, also known as ARP poisoning, is a method to attack an Ethernet network which may allow an attacker to sniff data frames on a LAN, modify the traffic, or stop the traffic altogether (known as a Denial of Service – DoS attack). The principle of ARP spoofing is to send the fake, or spoofed ARP messages to an Ethernet network. Generally, the aim is to associate the attacker's or random MAC address with the IP address of another node (such as the default gateway). Any traffic meant for that IP address would be mistakenly re-directed to the node specified by the attacker.

IP spoofing attack is caused by Gratuitous ARP that occurs when a host sends an ARP request to resolve its own IP address. Figure-4 shows a hacker within a LAN to initiate ARP spoofing attack.

Figure 4



In the Gratuitous ARP packet, the “Sender protocol address” and “Target protocol address” are filled with the same source IP address itself. The “Sender H/W Address” and “Target H/W address” are filled with the same source MAC address itself. The destination MAC address is the Ethernet broadcast address (FF-FF-FF-FF-FF-FF). All nodes within the network will immediately update their own ARP table in accordance with the sender’s MAC and IP address. The format of Gratuitous ARP is shown in the following table.

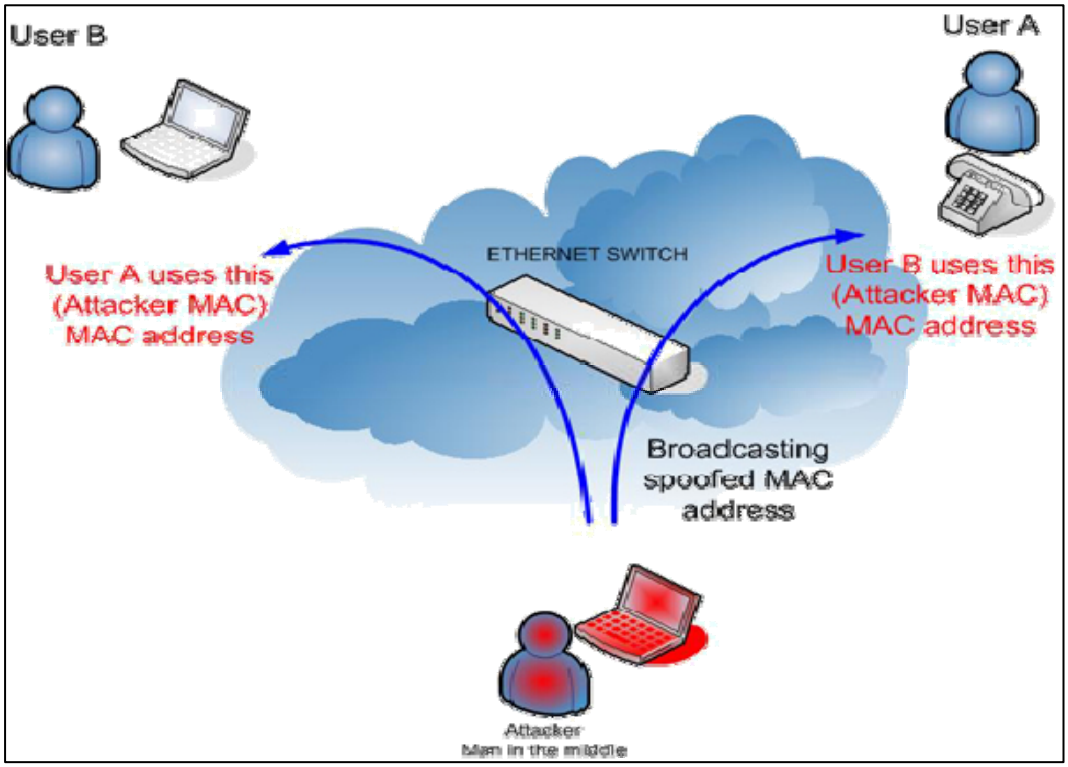
Table 5

Ethernet Header			Gratuitous ARP								
Destination Address	**Source Address**	**Ethernet Type**	**H/W Type**	**Protocol Type**	**H/W Address Length**	**Protocol Address Length**	**Operation**	**Sender H/W Address**	**Sender Protocol Address**	**Target H/W Address**	**Target Protocol Address**
(6-byte)	(6-byte)	(2-byte)	(2-byte)	(2-byte)	(1-byte)	(1-byte)	(2-byte)	(6-byte)	(4-byte)	(6-byte)	(4-byte)
FF-FF-FF-FF-FF-FF	00-20-5C-01-11-11	0806					**ARP relay**	***00-20-5C-01-11-11***	***10.10.10.254***	***00-20-5C-01-11-11***	***10.10.10.254***

A common DoS attack today can be done by associating a nonexistent or any specified MAC address to the IP address of the network’s default gateway. The malicious attacker only needs to broadcast one Gratuitous ARP to the network claiming it is the gateway so that the whole network operation will be turned down as all packets to the Internet will be directed to the wrong node.

Likewise, the attacker can either choose to forward the traffic to the actual default gateway (passive sniffing) or modify the data before forwarding it (man-in-the-middle attack). The hacker cheats the victim PC that it is a router and cheats the router that it is the victim. As can be seen in Figure 5 all traffic will be then sniffed by the hacker but the users will not discover.

Figure 5

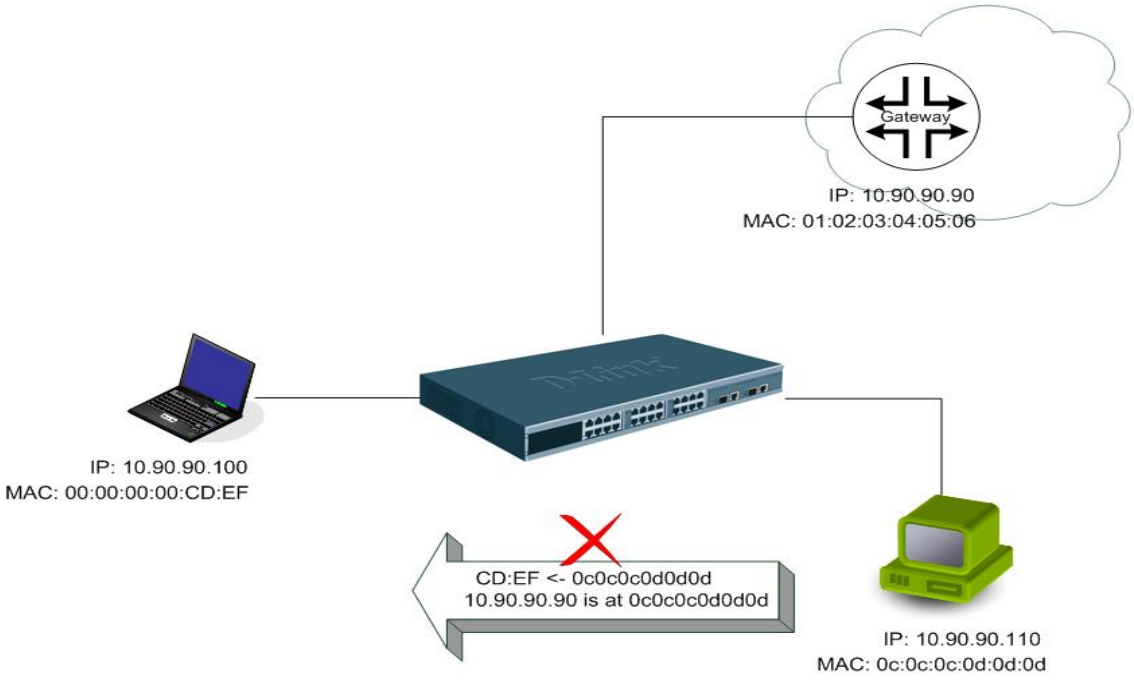


Prevent ARP Spoofing via Packet Content ACL

D-Link managed switches can effectively mitigate common DoS attacks caused by ARP spoofing via a unique Package Content ACL.

For the reason that basic ACL can only filter ARP packets based on packet type, VLAN ID, Source, and Destination MAC information, there is a need for further inspections of ARP packets. To prevent ARP spoofing attack, we will demonstrate here via using Packet Content ACL on the Switch to block the invalid ARP packets which contain faked gateway's MAC and IP binding.

Example topology



Configuration

The configuration logic is as follows:

1. Only if the ARP matches Source MAC address in Ethernet, Sender MAC address and Sender IP address in ARP protocol can pass through the switch. (In this example, it is the gateway's ARP.)
2. The switch will deny all other ARP packets which claim they are from the gateway's IP.

The design of Packet Content ACL on the Switch enables users to inspect any offset chunk. An offset chunk is a 4-byte block in a HEX format, which is utilized to match the individual field in an Ethernet frame. Each profile is allowed to contain up to a maximum of four offset chunks. Furthermore, only one single profile of Packet Content ACL can be supported per switch. In other words, up to 16 bytes of total offset chunks can be applied to each profile and a switch. Therefore, a careful consideration is needed for planning and configuration of the valuable offset chunks.

In Table 6, you will notice that the Offset_Chunk0 starts from the 127th byte and ends at the 128th byte. It also can be found that the offset chunk is scratched from 1 but not zero.

Table 6. Chunk and Packet Offset

Offset Chunk	Offset Chunk0	Offset Chunk1	Offset Chunk2	Offset Chunk3	Offset Chunk4	Offset Chunk5	Offset Chunk6	Offset Chunk7	Offset Chunk8	Offset Chunk9	Offset Chunk10	Offset Chunk11	Offset Chunk12	Offset Chunk13	Offset Chunk14	Offset Chunk15
Byte	127	3	7	11	15	19	23	27	31	35	39	43	47	51	55	59
Byte	128	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Byte	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61
Byte	2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62

Offset Chunk	Offset Chunk16	Offset Chunk17	Offset Chunk18	Offset Chunk19	Offset Chunk20	Offset Chunk21	Offset Chunk22	Offset Chunk23	Offset Chunk24	Offset Chunk25	Offset Chunk26	Offset Chunk27	Offset Chunk28	Offset Chunk29	Offset Chunk30	Offset Chunk31
Byte	63	67	71	75	79	83	87	91	95	99	103	107	111	115	119	123
Byte	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124
Byte	65	69	73	77	81	85	89	93	97	101	105	109	113	117	121	125
Byte	66	70	74	78	82	86	90	94	98	102	106	110	114	118	122	126

The following table indicates a completed ARP packet contained in Ethernet frame which is the pattern for the calculation of packet offset.

Table 7. A Completed ARP Packet Contained in an Ethernet Frame

Ethernet Header			ARP									
Destination Address	**Source Address**	**Ethernet Type**	**H/W Type**	**Protocol Type**	**H/W Address Length**	**Protocol Address Length**	**Operation**	**Sender H/W Address**	**Sender Protocol Address**	**Target H/W Address**	**Target Protocol Address**
(6-byte)	(6-byte) 01 02 03 04 05 06	(2-byte) 0806	(2-byte)	(2-byte)	(1-byte)	(1-byte)	(2-byte)	(6-byte)	(4-byte) 0a5a5a5a (10.90.90.90)	(6-byte)	(4-byte)

	Command	Description
Step1	create access_profile profile_id 1 profile_name 1 ethernet source_mac FF-FF-FF-FF-FF-FF ethernet_type	- Create access profile 1 To match Ethernet Type and Source MAC address.
Step2	config access_profile profile_id 1 add access_id 1 ethernet source_mac 01-02-03-04-05-06 ethernet_type 0x806 port 1-12 permit	- Configure access profile 1 - Only if the gateway's ARP packet that contains the correct Source MAC in the Ethernet frame can pass through the switch.
Step3	create access_profile profile_id 2 profile_name 2 packet_content_mask offset_chunk_1 3 0x0000FFFF Ethernet Type (2-byte) offset_chunk_2 7 0x0000FFFF SdrIP (First 2-byte) offset_chunk_3 8 0xFFFF0000 SdrIP (Last 2-byte)	- Create access profile 2 - The first Chunk starts from Chunk 3: mask for Ethernet Type (Blue in Table-6:13th & 14th bytes) - The second Chunk starts from Chunk 7: mask for Sender IP (First 2-byte) in ARP packet (Green in Table-6: 29th & 30th bytes) - The third Chunk starts from Chunk 8: mask for Sender IP (Last 2-byte) in ARP packet (Brown in Table-6: 31st & 32nd bytes)
Step4	config access_profile profile_id 2 add access_id 1 packet_content offset_chunk_1 0x00000806 Ethernet Type (2-byte):ARP offset_chunk_2 0x00000A5A SdrIP (First 2-byte): 10.90 offset_chunk_3 0x5A5A0000 SdrIP(Last 2-byte): 90.90 port 1-12 deny	- Configure access profile 2 - The rest of the ARP packets whose Sender IP claim they are the gateway's IP will be dropped.
Step5	Save	- Save config

Appendix B – Switch Log Entries

The following table lists all possible entries and their corresponding meanings that will appear in the System Log of this Switch.

Category	Event Description	Log Information	Severity	Remark
System	System started up	**Unit <unitID>, System started up**	Critical	
	Configuration saved to flash	**Unit <unitID>, Configuration saved to flash by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, there will no IP and MAC information for logging.
	System log saved to flash	**Unit <unitID>, System log saved to flash by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	"by console"and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, there will no IP and MAC information for logging.
	Configuration and log saved to flash	**Unit <unitID>, Configuration and log saved to flash by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, there will no IP and MAC information for logging.
	Side Fan failed	**Unit <unitID>, Side Fan failed**	Critical	For DGS-3200-16 Only
	Side Fan recovered	**Unit <unitID>, Side Fan recovered**	Critical	For DGS-3200-16 Only
Up/Down-load	Firmware upgraded successfully	**Unit <unitID>, Firmware upgraded by console successfully (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	“by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
	Firmware upgrade was unsuccessful	**Unit <unitID>, Firmware upgrade by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	“by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
	Configuration successfully downloaded	**Configuration successfully downloaded by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
	Configuration download was unsuccessful	**Configuration download by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging

	Configuration successfully uploaded	**Configuration successfully uploaded by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
	Configuration upload was unsuccessful	**Configuration upload by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
	Log message successfully uploaded	**Log message successfully uploaded by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
	Log message upload was unsuccessful	**Log message upload by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	"by console" and "IP": <ipaddr>, MAC: <macaddr>" are XOR shown in log string, which means if user login by console, will no IP and MAC information for logging
Interface	Port link up	**Port <unitID:portNum> link up, <link state>**	Informational	link state, for ex: , 100Mbps FULL duplex
Console	Port link down	**Port <unitID:portNum> link down**	Informational	There are no IP and MAC if login by console.
	Successful login through Console	**Unit <unitID>, Successful login through Console (Username: <username>)**	Informational	
	Login failed through Console	**Unit <unitID>, Login failed through Console (Username: <username>)**	Warning	There are no IP and MAC if login by console.
	Logout through Console	**Unit <unitID>, Logout through Console (Username: <username>)**	Informational	There are no IP and MAC if login by console.
	Console session timed out	**Unit <unitID>, Console session timed out (Username: <username>)**	Informational	There are no IP and MAC if login by console.
Web	Successful login through Web	**Successful login through Web (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	Login failed through Web	**Login failed through Web (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	
	Logout through Web	**Logout through Web (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	Successful login through Web (SSL)	**Successful login through Web (SSL) (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	

	Login failed through Web (SSL)	**Login failed through Web (SSL) (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	
	Logout through Web (SSL)	**Logout through Web (SSL) (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	Web (SSL) session timed out	**Web (SSL) session timed out (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
Telnet	Successful login through Telnet	**Successful login through Telnet (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	Login failed through Telnet	**Login failed through Telnet (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	
	Logout through Telnet	**Logout through Telnet (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	Telnet session timed out	**Telnet session timed out (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
SNMP	SNMP request received with invalid community string	**SNMP request received from <ipAddress> with invalid community string!**	Informational	
STP	Topology changed	**Topology changed (Instance: <InstanceID> port:<[unitID:] portNum>)]**	Informational	Detected Topology changed port
	New Root selected	**[CIST | MIST Regional] New root selected [([Instance: <InstanceID>] Root bridge MAC: <macaddr> Priority :<value>)]**	Informational	root bridge MAC address and priority at the instance
	Spanning Tree Protocol is enabled	**Spanning Tree Protocol is enabled**	Informational	
	Spanning Tree Protocol is disabled	**Spanning Tree Protocol is disabled**	Informational	
DoS	Spoofing attack	**Possible spoofing attack from <macAddress> port <portNum>**	Critical	
SSH	Successful login through SSH	**Successful login through SSH (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	Login failed through SSH	**Login failed through SSH (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Warning	
	Logout through SSH	**Logout through SSH (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	
	SSH session timed out	**SSH session timed out (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)**	Informational	

	SSH server is enabled	**SSH server is enabled**	Informational	
	SSH server is disabled	**SSH server is disabled**	Informational	
AAA	Authentication Policy is enabled	**Authentication Policy is enabled (Module: AAA)**	Informational	
	Authentication Policy is disabled	**Authentication Policy is disabled (Module: AAA)**	Informational	
	Successful login through Console authenticated by AAA local method	**Successful login through Console authenticated by AAA local method (Username: <username>)**	Informational	
	Login failed through Console authenticated by AAA local method	**Login failed through Console authenticated by AAA local method (Username: <username>)**	Warning	
	Successful login through Web authenticated by AAA local method	**Successful login through Web from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through Web authenticated by AAA local method	**Login failed failed through Web from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful login through Web (SSL) authenticated by AAA local method	**Successful login through Web (SSL) from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through Web (SSL) authenticated by AAA local method	**Login failed through Web (SSL) from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful login through Telnet authenticated by AAA local method	**Successful login through Telnet from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through Telnet authenticated by AAA local method	**Login failed through Telnet from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful login through SSH authenticated by AAA local method	**Successful login through SSH from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through SSH authenticated by	**Login failed through SSH from <userIP> authenticated by**	Warning	

	AAA local method	**AAA local method (Username: <username>, MAC: <macaddr>)**		
	Successful login through Console authenticated by AAA none method	**Successful login through Console authenticated by AAA none method (Username: <username>)**	Informational	
	Successful login through Web authenticated by AAA none method	**Successful login through Web from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful login through Web (SSL) authenticated by AAA none method	**Successful login through Web (SSL) from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful login through Telnet authenticated by AAA none method	**Successful login through Telnet from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful login through SSH authenticated by AAA none method	**Successful login through SSH from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful login through Console authenticated by AAA server	**Successful login through Console authenticated by AAA server <serverIP> (Username: <username>)**	Informational	There are no IP and MAC if login by console.
	Login failed through Console authenticated by AAA server	**Login failed through Console authenticated by AAA server <serverIP> (Username: <username>)**	Warning	There are no IP and MAC if login by console.
	Login failed through Console due to AAA server timeout or improper configuration	**Login failed through Console due to AAA server timeout or improper configuration (Username: <username>)**	Warning	
	Successful login through Web authenticated by AAA server	**Successful login through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through Web authenticated by AAA server	**Login failed through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	
	Login failed through Web due to AAA server timeout or improper configuration	**Login failed through Web from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC:**	Warning	

		<macaddr>)		
	Successful login through Web (SSL) authenticated by AAA server	**Successful login through Web(SSL) from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through Web (SSL) authenticated by AAA server	**Login failed through Web (SSL) from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	
	Login failed through Web (SSL) due to AAA server timeout or improper configuration	**Login failed through Web (SSL) from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful login through Telnet authenticated by AAA server	**Successful login through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Login failed through Telnet authenticated by AAA server	**Login failed through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful login through SSH authenticated by AAA server	**Successful login through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful Enable Admin through Console authenticated by AAA local_enable method	**Successful Enable Admin through Console authenticated by AAA local_enable method (Username: <username>)**	Informational	
	Enable Admin failed through Console authenticated by AAA local_enable method	**Enable Admin failed through Console authenticated by AAA local_enable method (Username: <username>)**	Warning	
	Successful Enable Admin through Web authenticated by AAA local_enable method	**Successful Enable Admin through Web from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)**	Informational	
	Enable Admin failed through Web authenticated by AAA local_enable method	**Enable Admin failed through Web from <userIP> authenticated by AAA local_enable method**	Warning	

		(Username: <username>, MAC: <macaddr>)		
	Successful Enable Admin through Telnet authenticated by AAA local_enable method	**Successful Enable Admin through Telnet from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful Enable Admin through SSH authenticated by AAA local_enable method	**Successful Enable Admin through SSH from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)**	Informational	
	Enable Admin failed through SSH authenticated by AAA local_enable method	**Enable Admin failed through SSH from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful Enable Admin through Console authenticated by AAA none method	**Successful Enable Admin through Console authenticated by AAA none method (Username: <username>)**	Informational	
	Successful Enable Admin through Web authenticated by AAA none method	**Successful Enable Admin through Web from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful Enable Admin through Web (SSL) authenticated by AAA none method	**Successful Enable Admin through Web (SSL) from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful Enable Admin through Telnet authenticated by AAA none method	**Successful Enable Admin through Telnet from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful Enable Admin through SSH authenticated by AAA none method	**Successful Enable Admin through SSH from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)**	Informational	
	Successful Enable Admin through Console authenticated by AAA server	**Successful Enable Admin through Console authenticated by AAA server <serverIP> (Username: <username>)**	Informational	

	Enable Admin failed through Console authenticated by AAA server	**Enable Admin failed through Console authenticated by AAA server <serverIP> (Username: <username>)**	Warning	
	Enable Admin failed through Console due to AAA server timeout or improper configuration	**Enable Admin failed through Console due to AAA server timeout or improper configuration (Username: <username>)**	Warning	
	Successful Enable Admin through Web authenticated by AAA server	**Successful Enable Admin through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Enable Admin failed through Web authenticated by AAA server	**Enable Admin failed through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	
	Enable Admin failed through Web due to AAA server timeout or improper configuration	**Enable Admin failed through Web from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful Enable Admin through Web (SSL) authenticated by AAA server	**Successful Enable Admin through Web (SSL) from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Enable Admin failed through Web (SSL) authenticated by AAA server	**Enable Admin failed through Web (SSL) from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	
	Enable Admin failed through Web (SSL) due to AAA server timeout or improper configuration	**Enable Admin failed through Web (SSL) from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful Enable Admin through Telnet authenticated by AAA server	**Successful Enable Admin through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Enable Admin failed through Telnet authenticated by AAA server	**Enable Admin failed through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	

	Enable Admin failed through Telnet due to AAA server timeout or improper configuration	**Enable Admin failed through Telnet from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC: <macaddr>)**	Warning	
	Successful Enable Admin through SSH authenticated by AAA server	**Successful Enable Admin through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Informational	
	Enable Admin failed through SSH authenticated by AAA server	**Enable Admin failed through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)**	Warning	
	Enable Admin failed through SSH due to AAA server timeout or improper configuration	**Enable Admin failed through SSH from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC: <macaddr>)**	Warning	
	AAA server timed out	**AAA server <serverIP> (Protocol: <protocol>) connection failed**	Warning	<protocol> is one of TACACS, XTACACS, TACACS+, RADIUS
	AAA server ACK error	**AAA server <serverIP> (Protocol: <protocol>) response is wrong**	Warning	<protocol> is one of TACACS, XTACACS, TACACS+, RADIUS
	AAA does not support this functionality	**AAA doesn't support this functionality**	Informational	
IP-MAC-PORT Binding	Unauthenticated IP address and discard by IP MAC port binding	**Unauthenticated IP-MAC address and discarded by IP MAC port binding (IP: <ipaddr>, MAC: <macaddr>, Port <unitID:portNum>)**	Warning	
	Unauthenticated IP address encountered and discarded by ip IP-MAC port binding	**Unauthenticated IP-MAC address and discarded by IP-MAC port binding (IP: <ipaddr>, MAC: <macaddr>, Port: <unitID:portNum>)**	Warning	
IP and Password Changed	IP Address change activity	**Unit <unitID>, Management IP address was changed by (Username: <username>,IP:<ipaddr>,MAC :<macaddr>)**	Informational	
	Password change activity	**Unit <unitID>, Password was changed by (Username: <username>,IP:<ipaddr>,MAC :<macaddr>)**	Informational	
Dual Configuration	Excution error encountered druring system boot-up	**Configuration had <int> syntax error and <int> execute error**	Warning	

Safeguard Engine	Safeguard Engine is in normal mode	**Safeguard Engine enters NORMAL mode**	Informational	
	Safeguard Engine is in filtering packet mode	**Safeguard Engine enters EXHAUSTED mode**	Warning	
Packet Storm	Broadcast strom occurrence	**Port <unitID:portNum> Broadcast storm is occurring**	Warning	
	Broadcast storm cleared	**Port <unitID:portNum> Broadcast storm has cleared**	Informational	
	Multicast storm occurrence	**Port <unitID:portNum> Multicast storm is occurring**	Warning	
	Multicast storm cleared	**Port <unitID:portNum> Multicast storm has cleared**	Informational	
	Port shut down due to a packet storm	**Port <unitID:portNum> is currently shut down due to a packet storm**	Warning	
JWAC	Login OK	**JWAC login successful (Username:%s,IP:%s,MAC:%s ,Port:%s)**	Informational	
	Login Fail	**JWAC login rejected (Username:%s,IP:%s,MAC:%s ,Port:%s)**	Warning	
	Logout normal	**JWAC host logout normally (Username:%s,IP:%s,MAC:%s ,Port:%s)**	Informational	
	Logout forcibly	**JWAC host logout forcibly (Username:%s,IP:%s,MAC:%s ,Port:%s)**	Warning	
	Age out	**JWAC host age out (Username:%s,IP:%s,MAC:%s ,Port:%s)**	Informational	
Loopback Detection	Port loop occurred	**Port <[unitID:]portNum> LBD loop occurred. Port blocked.**	Critical	
	Port loop detection restarted after interval time	**Port <[unitID:]portNum> LBD port recovered. Loop detection restarted.**	Informational	
	Port with VID loop occurred	**Port <[unitID:]portNum> VID vvlanID> LBD loop occurred. Packet discard begun.**	Critical	
	Port with VID Loop detection restarted after interval time	**Port <[unitID:]portNum> VID <vlanID> LBD recovered. Loop detection restarted.**	Informational	
802.1X	VID assigned from RADIUS server after RADIUS client authenticated by RADIUS server successfully. This VID will assign to the port and this port will be the VLAN untagged port member.	**Radius server <ipaddr> assigned vid :<vlanID> to port <[unitID:]portNum> (account :<username>)**	Informational	stand-alone device port <portNum> stackable device Port: <unitID:portNum>

	Ingress bandwidth assigned from RADIUS server after RADIUS client authenticated by RADIUS server successfully. This Ingress bandwidth will assign to the port.	**Radius server <ipaddr> assigned ingress bandwith :<ingressBandwidth > to port <[unitID:]portNum> (account : <username>)**	Informational	stand-alone device port <portNum> stackable device Port: <unitID:portNum>
	Egress bandwidth assigned from RADIUS server after RADIUS client authenticated by RADIUS server successfully. This egress bandwidth will assign to the port.	**Radius server <ipaddr> assigned egress bandwith :<egressBandwidth> to port <[unitID:]portNum> (account: <username>)**	Informational	stand-alone device port <portNum> stackable device Port: <unitID:portNum>
	802.1p default priority assigned from RADIUS server after RADIUS client authenticated by RADIUS server successfully. This 802.1p default priority will assign to the port.	**Radius server <ipaddr> assigned 802.1p deafult priority:<priority> to port <[unitID:]portNum> (account : <username>)**	Informational	stand-alone device port <portNum> stackable device Port: <unitID:portNum>
	802.1X Authentication failure	**802.1x Authentication failure [for <reason>] from (Username: <username>, Port: <[unitID:]portNum>, MAC: <macaddr>)**	Warning	stand-alone device port <portNum> stackable device Port: <unitID:portNum>
	802.1X Authentication success	**802.1x Authentication success from (Username: <username>, Port: <[unitID:]portNum>, MAC: <macaddr>)**	Informational	stand-alone device port <portNum> stackable device Port: <unitID:portNum>
DHCP	Detect untrusted DHCP server IP address	**Detected untrusted DHCP server(IP: <ipaddr>, Port: <[unitID:]portNum>)**	Informational	
MBAC				
	Login OK	**MAC-AC login successful (MAC: <macaddr>, port: <[unitID:]portNum>, VID: <vlanID>)**	Informational	
	Login Fail	**MAC-AC login rejected (MAC: <macaddr>, port: <[unitID:]portNum>, VID: <vlanID>)**	Warning	
	Aged out	**MAC-AC host aged out (MAC: <macaddr>, port: <[unitID:]portNum>, VID: <vlanID>)**	Informational	

Appendix C – Trap Logs

This table lists the trap logs found on the DGS-3200 Series Switches.

MACNotifyTrap	*This trap indicates the MAC address variations in the address table.*	*1.3.6.1.4.1.171.11.101.1.2.100.1.2.0.1*
PortSecVioTrap	*When the port security trap is enabled, new MAC addresses that violate the pre-defined port security configuration will trigger trap messages to be sent out.*	*1.3.6.1.4.1.171.11.101.1.2.100.1.2.0.2*
PortLoopOccurredTrap	*This trap is sent when a Port loop occurs.*	*1.3.6.1.4.1.171.11.101.1.2.100.1.2.0.3*
PortLoopRestart	*This trap is sent when a Port loop restarts after the interval time.*	*1.3.6.1.4.1.171.11.101.1.2.100.1.2.0.4*
VlanLoopOccurred	*This trap is sent when a Port with a VID loop occurs.*	*1.3.6.1.4.1.171.11.101.1.2.100.1.2.0.5*
VlanLoopRestart	*This trap is sent when a Port with a VID loop restarts after the interval time.*	*1.3.6.1.4.1.171.11.101.1.2.100.1.2.0.6*
CpuProtectChgToExhausted	*This trap indicates System change operation mode from normal to exhausted.*	*1.3.6.1.4.1.171.12.19.4.1.0.1*
SafeGuardChgToNormal	*This trap indicates System change operation mode from exhausted to normal.*	*1.3.6.1.4.1.171.12.19.4.1.0.2*
PktStormOccurred	*This trap is sent when a packet storm is detected by the packet storm mechanism and takes shutdown as an action.*	*1.3.6.1.4.1.171.12.25.5.0.1*
PktStormCleared	*This trap is sent when the packet storm is cleared by the packet storm mechanism.*	*1.3.6.1.4.1.171.12.25.5.0.2*
IpMACBindTrap	*When the IP-MAC Binding trap is enabled, if there's a new MAC that violates the pre-defined port security configuration, a trap will be sent out.*	*1.3.6.1.4.1.171.12.23.5.0.1*
MacBasedAuthLoggedSuccess	*This trap is sent when a MAC-based access control host is successfully logged in.*	*1.3.6.1.4.1.171.12.35.11.1.0.1*
MacBasedAuthLoggedFail	*This trap is sent when a MAC-based access control host login fails.*	*1.3.6.1.4.1.171.12.35.11.1.0.2*
MacBasedAuthAgesOut	*This trap is sent when a MAC-based access control host ages out.*	*1.3.6.1.4.1.171.12.35.11.1.0.3*

FilterDetectedTrap	*This trap is sent when an illegal DHCP server is detected. The same illegal DHCP server IP address detected is just sent once to the trap receivers within the log ceasing unauthorized duration.*	*1.3.6.1.4.1.171.12.37.100.0.1*
SingleIPMSColdStart	*The commander switch will send swSingleIPMSColdStart notification to the indicated*	*1.3.6.1.4.1.171.12.8.6.0.11*
SingleIPMSWarmStart	*The commander switch will send swSingleIPMSWarmStart notification to the indicated host when its member generates a warm start notification.*	*1.3.6.1.4.1.171.12.8.6.0.12*
SingleIPMSLinkDown	*The commander switch will send swSingleIPMSLinkDown notification to the indicated host when its member generates a link down notification.*	*1.3.6.1.4.1.171.12.8.6.0.13*
SingleIPMSLinkUp	*The commander switch will send swSingleIPMSLinkUp notification to the indicated host when its member generates a link up notification.*	*1.3.6.1.4.1.171.12.8.6.0.14*
SingleIPMSAuthFail	*The commander switch will send swSingleIPMSAuthFail notification to the indicated host when its member generates an authentation failure notification*	*1.3.6.1.4.1.171.12.8.6.0.15*
SingleIPMSnewRoot	*The commander switch will send swSingleIPMSnewRoot notification to the indicated host when its member generates a new root notification.*	*1.3.6.1.4.1.171.12.8.6.0.16*
SingleIPMSTopologyChange	*The commander switch will send swSingleIPMSTopologyChange notification to the indicated host when its member generates a topology change notification.*	*1.3.6.1.4.1.171.12.8.6.0.17*
coldStart	*A coldStart trap signifies that the sending protocol entity is reinitializing itself such that the agent's configuration or the protocol entity implementation may be altered.*	*1.3.6.1.6.3.1.1.5.1*
warmStart	*A warmStart trap signifies that the sending protocol entity is reinitializing itself such that neither the agent configuration nor the protocol entity implementation is altered.*	*1.3.6.1.6.3.1.1.5.2*

linkDown	*A linkDown trap signifies that the sending protocol entity recognizes a failure in one of the communication links represented in the agent's configuration.*	*1.3.6.1.6.3.1.1.5.3*
linkUp	*A linkUp trap signifies that the sending protocol entity recognizes that one of the communication links represented in the agent's configuration has come up.*	*1.3.6.1.6.3.1.1.5.4*
authenticationFailure	*An authenticationFailure trap signifies that the sending protocol entity is the address of a protocol message that is not properly authenticated.While implementations of the SNMP must be capable of generating this trap, they must also be capable of suppressing the emission of such traps via an implementation- specific mechanism.*	*1.3.6.1.6.3.1.1.5.5*
RisingAlarmTrap	*This trap is an SNMP notification that is generated when a high capacity alarm entry crosses its rising threshold and generates an event that is configured for sending SNMP traps.*	*1.3.6.1.2.1.16.29.2.0.1*
FallingAlarmTrap	*This trap is an SNMP notification that is generated when a high capacity alarm entry crosses its falling threshold and generates an event that is configured for sending SNMP traps.*	*1.3.6.1.2.1.16.29.2.0.2*
newRoot	*The newRoot trap indicates that the sending agent has become the new root of the Spanning Tree; the trap is sent by a bridge soon after its election as the new root, e.g., upon action of the Topology Change Timer immediately subsequent to its election. Implementation of this trap is optional.*	*1.3.6.1.2.1.17.0.1*
topologyChange	*A topologyChange trap is sent by a bridge when any of its configured ports transitions from the Learning state to the Forwarding state, or from the Forwarding state to the Blocking state. The trap is not sent if a newRoot trap is sent for the same transition. Implementation of this trap is optional.*	*1.3.6.1.2.1.17.0.2*

Appendix D – Password Recovery Procedure

This document describes the procedure for resetting passwords on D-Link Switches.

Authenticating any user who tries to access networks is necessary and important. The basic authentication method used to accept qualified users is through a local login, utilizing a Username and Password. Sometimes, passwords get forgotten or destroyed, so network administrators need to reset these passwords. This document will explain how the Password Recovery feature can help network administrators reach this goal.

The following steps explain how to use the Password Recovery feature on D-Link devices to easily recover passwords.

Complete these steps to reset the password:

1. For security reasons, the Password Recovery feature requires the user to physically access the device. Therefore this feature is only applicable when there is a direct connection to the console port of the device. It is necessary for the user needs to attach a terminal or PC with terminal emulation to the console port of the switch.
2. Power on the Switch. After the runtime image is loaded to 100%, the Switch will allow 2 seconds for the user to press the hotkey [^] (Shift + 6) to enter the "Password Recovery Mode." Once the Switch enters the "Password Recovery Mode," all ports on the Switch will be disabled.

```
Boot Procedure                                                    V1.00.B006
--------------------------------------------------------------------------------

  Power On Self Test ....................................  100%

  MAC Address   : 00-19-5B-EC-32-15
  H/W Version   : A1

  Please wait, loading V1.35.B019 Runtime image.............  00 %

The switch is now entering Password Recovery Mode:_
```

```
The switch is currently in Password Recovery Mode.
>
```

3. In the "Password Recovery Mode" only the following commands can be used.

Command	Parameters
reset config	The **reset config** command resets the whole configuration back to the default values.
reboot	The **reboot** command exits the Reset Password Recovery Mode and restarts the switch. A confirmation message will be displayed to allow the user to save the current settings.
reset account	The **reset** account command deletes all the previously created accounts.
reset password {<username>}	The **reset password** command resets the password of the specified user. If a username is not specified, the passwords of all users will be reset.
show account	The **show account** command displays all previously created accounts.

Appendix E – Glossary

1000BASE-SX: A short laser wavelength on multimode fiber optic cable for a maximum length of 2 kilometers.

1000BASE-LX: A long wavelength for a "long haul" fiber optic cable for a maximum length of 10 kilometers.

100BASE-FX: 100Mbps Ethernet implementation over fiber.

100BASE-TX: 100Mbps Ethernet implementation over Category 5 and Type 1 Twisted Pair cabling.

10BASE-T: The IEEE 802.3 specification for Ethernet over Unshielded Twisted Pair (UTP) cabling.

aging: The automatic removal of dynamic entries from the Switch Database which have timed-out and are no longer valid.

ATM: Asynchronous Transfer Mode. A connection oriented transmission protocol based on fixed length cells (packets). ATM is designed to carry a complete range of user traffic, including voice, data and video signals.

auto-negotiation: A feature on a port which allows it to advertise its capabilities for speed, duplex and flow control. When connected to an end station that also supports auto-negotiation, the link can self-detect its optimum operating setup.

backbone port: A port which does not learn device addresses, and which receives all frames with an unknown address. Backbone ports are normally used to connect the Switch to the backbone of your network. Note that backbone ports were formerly known as designated downlink ports.

backbone: The part of a network used as the primary path for transporting traffic between network segments.

bandwidth: Information capacity, measured in bits per second, that a channel can transmit. The bandwidth of Ethernet is 10Mbps, the bandwidth of Fast Ethernet is 100Mbps.

baud rate: The switching speed of a line. Also known as line speed between network segments.

BOOTP: The BOOTP protocol allows automatic mapping of an IP address to a given MAC address each time a device is started. In addition, the protocol can assign the subnet mask and default gateway to a device.

bridge: A device that interconnects local or remote networks no matter what higher level protocols are involved. Bridges form a single logical network, centralizing network administration.

broadcast: A message sent to all destination devices on the network.

broadcast storm: Multiple simultaneous broadcasts that typically absorb available network bandwidth and can cause network failure.

console port: The port on the Switch accepting a terminal or modem connector. It changes the parallel arrangement of data within computers to the serial form used on data transmission links. This port is most often used for dedicated local management.

CSMA/CD: Channel access method used by Ethernet and IEEE 802.3 standards in which devices transmit only after finding the data channel clear for some period of time. When two devices transmit simultaneously, a collision occurs and the colliding devices delay their retransmissions for a random amount of time.

data center switching: The point of aggregation within a corporate network where a switch provides high-performance access to server farms, a high-speed backbone connection and a control point for network management and security.

Ethernet: A LAN specification developed jointly by Xerox, Intel and Digital Equipment Corporation. Ethernet networks operate at 10Mbps using CSMA/CD to run over cabling.

Fast Ethernet: 100Mbps technology based on the CSMA/CD network access method.

Flow Control: (IEEE 802.3X) A means of holding packets back at the transmit port of the connected end station. Prevents packet loss at a congested switch port.

forwarding: The process of sending a packet toward its destination by an internetworking device.

full duplex: A system that allows packets to be transmitted and received at the same time and, in effect, doubles the potential throughput of a link.

half duplex: A system that allows packets to be transmitted and received, but not at the same time. Contrast with full duplex.

IP address: Internet Protocol address. A unique identifier for a device attached to a network using TCP/IP. The address is written as four octets separated with full-stops (periods), and is made up of a network section, an optional subnet section and a host section.

IPX: Internetwork Packet Exchange. A protocol allowing communication in a NetWare network.

LAN - Local Area Network: A network of connected computing resources (such as PCs, printers, servers) covering a relatively small geographic area (usually not larger than a floor or building). Characterized by high data rates and low error rates.

latency: The delay between the time a device receives a packet and the time the packet is forwarded out of the destination port.

line speed: See baud rate.

main port: The port in a resilient link that carries data traffic in normal operating conditions.

MDI - Medium Dependent Interface: An Ethernet port connection where the transmitter of one device is connected to the receiver of another device.

MDI-X - Medium Dependent Interface Cross-over: An Ethernet port connection where the internal transmit and receive lines are crossed.

MIB - Management Information Base: Stores a device's management characteristics and parameters. MIBs are used by the Simple Network Management Protocol (SNMP) to contain attributes of their managed systems. The Switch contains its own internal MIB.

multicast: Single packets copied to a specific subset of network addresses. These addresses are specified in the destination-address field of the packet.

protocol: A set of rules for communication between devices on a network. The rules dictate format, timing, sequencing and error control.

resilient link: A pair of ports that can be configured so that one will take over data transmission should the other fail. See also main port and standby port.

RJ-45: Standard 8-wire connectors for IEEE 802.3 10BASE-T networks.

RMON: Remote Monitoring. A subset of SNMP MIB II that allows monitoring and management capabilities by addressing up to ten different groups of information.

RPS - Redundant Power System: A device that provides a backup source of power when connected to the Switch.

server farm: A cluster of servers in a centralized location serving a large user population.

SLIP - Serial Line Internet Protocol: A protocol which allows IP to run over a serial line connection.

SNMP - Simple Network Management Protocol: A protocol originally designed to be used in managing TCP/IP internets. SNMP is presently implemented on a wide range of computers and networking equipment and may be used to manage many aspects of network and end station operation.

Spanning Tree Protocol (STP): A bridge-based system for providing fault tolerance on networks. STP works by allowing the user to implement parallel paths for network traffic, and ensure that redundant paths are disabled when the main paths are operational and enabled if the main paths fail.

standby port: The port in a resilient link that will take over data transmission if the main port in the link fails.

switch: A device which filters, forwards and floods packets based on the packet's destination address. The switch learns the addresses associated with each switch port and builds tables based on this information to be used for the switching decision.

TCP/IP: A layered set of communications protocols providing Telnet terminal emulation, FTP file transfer, and other services for communication among a wide range of computer equipment.

Telnet: A TCP/IP application protocol that provides virtual terminal service, letting a user log in to another computer system and access a host as if the user were connected directly to the host.

TFTP - Trivial File Transfer Protocol: Allows the user to transfer files (such as software upgrades) from a remote device using your switch's local management capabilities.

UDP - User Datagram Protocol: An Internet standard protocol that allows an application program on one device to send a datagram to an application program on another device.

VLAN - Virtual LAN: A group of location- and topology-independent devices that communicate as if they are on a common physical LAN.

VLT - Virtual LAN Trunk: A Switch-to-Switch link which carries traffic for all the VLANs on each Switch.

VT100: A type of terminal that uses ASCII characters. VT100 screens have a text-based appearance.

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Warranty and Support (USA Only)

Subject to the terms and conditions set forth herein, D-Link Systems, Inc. (“D-Link”) provides this lifetime product warranty for hardware:

- Only for products purchased, delivered and used within the fifty states of the United States, the District of Columbia, U.S. Possessions or Protectorates, U.S. Military Installations, or addresses with an APO or FPO, and;
- Only with proof of purchase.

Product Warranty: D-Link warrants that the hardware portion of the D-Link product, including internal and external power supplies and fans (“Hardware”), will be free from material defects in workmanship and materials under normal use from the date of original retail purchase of the product (“Warranty Period”), except as otherwise stated herein.

The customer's sole and exclusive remedy and the entire liability of D-Link and its suppliers under this Warranty will be, at D-Link’s option, to repair or replace the defective Hardware during the Warranty Period at no charge to the owner or to refund the actual purchase price paid. Any repair or replacement will be rendered by D-Link at an Authorized D-Link Service Office. The replacement hardware need not be new or have an identical make, model or part. D-Link may, at its option, replace the defective Hardware or any part thereof with any reconditioned product that D-Link reasonably determines is substantially equivalent (or superior) in all material respects to the defective Hardware. Repaired or replacement hardware will be warranted for the remainder of the original Warranty Period or ninety (90) days, whichever is longer, and is subject to the same limitations and exclusions. If a material defect is incapable of correction, or if D-Link determines that it is not practical to repair or replace the defective Hardware, the actual price paid by the original purchaser for the defective Hardware will be refunded by D-Link upon return to D-Link of the defective Hardware. All Hardware or part thereof that is replaced by D-Link, or for which the purchase price is refunded, shall become the property of D-Link upon replacement or refund.

Software Warranty: D-Link warrants that the software portion of the product (“Software”) will substantially conform to D-Link’s then current functional specifications for the Software, as set forth in the applicable documentation, from the date of original retail purchase of the Software for a period of ninety (90) days (“Software Warranty Period”), provided that the Software is properly installed on approved hardware and operated as contemplated in its documentation. D-Link further warrants that, during the Software Warranty Period, the magnetic media on which D-Link delivers the Software will be free of physical defects. The customer's sole and exclusive remedy and the entire liability of D-Link and its suppliers under this Limited Warranty will be, at D-Link’s option, to replace the non-conforming Software (or defective media) with software that substantially conforms to D-Link’s functional specifications for the Software or to refund the portion of the actual purchase price paid that is attributable to the Software. Except as otherwise agreed by D-Link in writing, the replacement Software is provided only to the original licensee, and is subject to the terms and conditions of the license granted by D-Link for the Software. Replacement Software will be warranted for the remainder of the original Warranty Period and is subject to the same limitations and exclusions. If a material non-conformance is incapable of correction, or if D-Link determines in its sole discretion that it is not practical to replace the non-conforming Software, the price paid by the original licensee for the non-conforming Software will be refunded by D-Link; provided that the non-conforming Software (and all copies thereof) is first returned to D-Link. The license granted respecting any Software for which a refund is given automatically terminates.

Non-Applicability of Warranty: The Warranty provided hereunder for D-Link's products will not be applied to and does not cover any products obtained through a special or unique pricing agreement, if such agreement provides for warranty terms different from those normally provided with the product or set forth herein, nor to any refurbished product and any product purchased through the inventory clearance or liquidation sale or other sales in which D-Link, the sellers, or the liquidators expressly disclaim their warranty obligation pertaining to the product and in that case, the product is being sold "As-Is" without any warranty whatsoever including, without limitation, the Warranty as described herein, notwithstanding anything stated herein to the contrary.

Submitting A Claim: The customer shall return the product to the original purchase point based on its return policy. In case the return policy period has expired and the product is within warranty, the customer shall submit a claim to D-Link as outlined below:

- The customer must submit with the product as part of the claim a written description of the Hardware defect or Software nonconformance in sufficient detail to allow D-Link to confirm the same, along with proof of purchase of the product (such as a copy of the dated purchase invoice for the product).
- The customer must obtain a Case ID Number from D-Link Technical Support by going to https://support.dlink.com, who will attempt to assist the customer in resolving any suspected defects with the product. If the product is considered defective, the customer must obtain a Return Material Authorization (“RMA”) number by completing the RMA form and entering the assigned Case ID Number at https://rma.dlink.com/.
- After an RMA number is issued, the defective product must be packaged securely in the original or other suitable shipping package to ensure that it will not be damaged in transit, and the RMA number must be prominently marked on the outside of the package. Include any manuals or accessories in the shipping package.
- The customer is responsible for all in-bound shipping charges to D-Link. No Cash on Delivery (“COD”) is allowed. Products sent COD will either be rejected by D-Link or become the property of D-Link. Products shall be fully insured by the customer and shipped to **D-Link Systems, Inc., 17595 Mt. Herrmann, Fountain Valley, CA 92708**. D-Link will not be held responsible for any packages that are lost in transit to D-Link. The repaired or replaced packages will be shipped to the customer via UPS Ground or any common carrier selected by D-Link. Return shipping charges shall be prepaid by D-Link if you use an address in the United States, otherwise we will ship the product to you freight collect. Expedited shipping is available upon request and provided shipping charges are prepaid by the customer.

D-Link may reject or return any product that is not packaged and shipped in strict compliance with the foregoing requirements, or for which an RMA number is not visible from the outside of the package. The product owner agrees to pay D-Link’s reasonable handling and return shipping charges for any product that is not packaged and shipped in accordance with the foregoing requirements, or that is determined by D-Link not to be defective or non-conforming.

What Is Not Covered: The Warranty provided herein by D-Link does not cover: Products that, in D-Link’s judgment, have been subjected to abuse, accident, alteration, modification, tampering, negligence, misuse, faulty installation, lack of reasonable care, repair or service in any way that is not contemplated in the documentation for the product, or if the model or serial number has been altered, tampered with, defaced or removed; Initial installation, installation and removal of the product for repair, and shipping costs; Operational adjustments covered in the operating manual for the product, and normal maintenance; Damage that occurs in shipment, due to act of God, failures due to power surge, and cosmetic damage; Any hardware, software, firmware or other products or services provided by anyone other than D-Link; and Products that have been purchased from inventory clearance or liquidation sales or other sales in which D-Link, the sellers, or the liquidators expressly disclaim their warranty obligation pertaining to the product. While necessary maintenance or repairs on your Product can be performed by any company, we recommend that you use only an Authorized D-Link Service Office. Improper or incorrectly performed maintenance or repair voids this Warranty.

Disclaimer of Other Warranties: EXCEPT AS SPECIFICALLY SET FORTH ABOVE OR AS REQUIRED BY LAW, THE PRODUCT IS PROVIDED “AS-IS” WITHOUT ANY WARRANTY OF ANY KIND WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT. IF ANY IMPLIED WARRANTY CANNOT BE DISCLAIMED IN ANY TERRITORY WHERE A PRODUCT IS SOLD, THE DURATION OF SUCH IMPLIED WARRANTY SHALL BE LIMITED TO NINETY (90) DAYS. EXCEPT AS EXPRESSLY COVERED UNDER THE WARRANTY PROVIDED HEREIN, THE ENTIRE RISK AS TO THE QUALITY, SELECTION AND PERFORMANCE OF THE PRODUCT IS WITH THE PURCHASER OF THE PRODUCT.

Limitation of Liability: TO THE MAXIMUM EXTENT PERMITTED BY LAW, D-LINK IS NOT LIABLE UNDER ANY CONTRACT, NEGLIGENCE, STRICT LIABILITY OR OTHER LEGAL OR EQUITABLE THEORY FOR ANY LOSS OF USE OF THE PRODUCT, INCONVENIENCE OR DAMAGES OF ANY CHARACTER, WHETHER DIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL (INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF GOODWILL, LOSS OF REVENUE OR PROFIT, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, FAILURE OF OTHER EQUIPMENT OR COMPUTER PROGRAMS TO WHICH D-LINK'S PRODUCT IS CONNECTED WITH, LOSS OF INFORMATION OR DATA CONTAINED IN, STORED ON, OR INTEGRATED WITH ANY PRODUCT RETURNED TO D-LINK FOR WARRANTY SERVICE) RESULTING FROM THE USE OF THE PRODUCT, RELATING TO WARRANTY SERVICE, OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, EVEN IF D-LINK HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE SOLE REMEDY FOR A BREACH OF THE FOREGOING WARRANTY IS REPAIR, REPLACEMENT OR REFUND OF THE DEFECTIVE OR NON-CONFORMING PRODUCT. THE MAXIMUM LIABILITY OF D-LINK UNDER THIS WARRANTY IS LIMITED TO THE PURCHASE PRICE OF THE PRODUCT COVERED BY THE WARRANTY. THE FOREGOING EXPRESS WRITTEN WARRANTIES AND REMEDIES ARE EXCLUSIVE AND ARE IN LIEU OF ANY OTHER WARRANTIES OR REMEDIES, EXPRESS, IMPLIED OR STATUTORY.

Lifetime Warranty: IF LOCAL LAW MANDATES THE USE OF A DEFINITION OF "LIFETIME WARRANTY" DIFFERENT FROM THAT PROVIDED HEREIN, THEN THE LOCAL LAW DEFINITION WILL SUPERSEDE AND TAKE PRECEDENCE, TO THE EXTENT NECESSARY TO COMPLY.

Governing Law: This Warranty shall be governed by the laws of the State of California. Some states do not allow exclusion or limitation of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the foregoing limitations and exclusions may not apply. This Warranty provides specific legal rights and you may also have other rights which vary from state to state.

Trademarks: D-Link is a registered trademark of D-Link Systems, Inc. Other trademarks or registered trademarks are the property of their respective owners.

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CE Mark Warning: This is a Class A product. In a residential environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

FCC Statement: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. Operation of this equipment in a residential environment is likely to cause harmful interference to radio or television reception. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures**:**

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For detailed warranty information applicable to products purchased outside the United States, please contact the corresponding local D-Link office.

Product Registration

Register your D-Link product online at http://support.dlink.com/register/
Product registration is entirely voluntary and failure to complete or return this form will not diminish your warranty rights.

LIMITED WARRANTY (Exclude USA, Europe, China and Taiwan)

D-Link provides this limited warranty for its product only to the person or entity who originally purchased the product from D-Link or its authorized reseller or distributor. D-Link would fulfill the warranty obligation according to the local warranty policy in which you purchased our products.

Limited Hardware Warranty: D-Link warrants that the hardware portion of the D-Link products described below ("Hardware") will be free from material defects in workmanship and materials from the date of original retail purchase of the Hardware, for the period set forth below applicable to the product type ("Warranty Period") if the Hardware is used and serviced in accordance with applicable documentation; provided that a completed Registration Card is returned to an Authorized D-Link Service Office within ninety (90) days after the date of original retail purchase of the Hardware. If a completed Registration Card is not received by an authorized D-Link Service Office within such ninety (90) period, then the Warranty Period shall be ninety (90) days from the date of purchase.

Product Type	***Warranty Period***
Product (including Power Supplies and Fans)	One (1) Year
Spare parts and pare kits	Ninety (90) days

D-Link's sole obligation shall be to repair or replace the defective Hardware at no charge to the original owner. Such repair or replacement will be rendered by D-Link at an Authorized D-Link Service Office. The replacement Hardware need not be new or of an identical make, model or part; D-Link may in its discretion replace the defective Hardware (or any part thereof) with any reconditioned product that D-Link reasonably determines is substantially equivalent (or superior) in all material respects to the defective Hardware. The Warranty Period shall extend for an additional ninety (90) days after any repaired or replaced Hardware is delivered. If a material defect is incapable of correction, or if D-Link determines in its sole discretion that it is not practical to repair or replace the defective Hardware, the price paid by the original purchaser for the defective Hardware will be refunded by D-Link upon return to D-Link of the defective Hardware. All Hardware (or part thereof) that is replaced by D-Link, or for which the purchase price is refunded, shall become the property of D-Link upon replacement or refund.

Limited Software Warranty: D-Link warrants that the software portion of the product ("Software") will substantially conform to D-Link's then current functional specifications for the Software, as set forth in the applicable documentation, from the date of original delivery of the Software for a period of ninety (90) days ("Warranty Period"), if the Software is properly installed on approved hardware and operated as contemplated in its documentation. D-Link further warrants that, during the Warranty Period, the magnetic media on which D-Link delivers the Software will be free of physical defects. D-Link's sole obligation shall be to replace the non-conforming Software (or defective media) with software that substantially conforms to D-Link's functional specifications for the Software. Except as otherwise agreed by D-Link in writing, the replacement Software is provided only to the original licensee, and is subject to the terms and conditions of the license granted by D-Link for the Software. The Warranty Period shall extend for an additional ninety (90) days after any replacement Software is delivered. If a material non-conformance is incapable of correction, or if D-Link determines in its sole discretion that it is not practical to replace the non-conforming Software, the price paid by the original licensee for the non-conforming Software will be refunded by D-Link; provided that the non-conforming Software (and all copies thereof) is first returned to D-Link. The license granted respecting any Software for which a refund is given automatically terminates.

What You Must Do For Warranty Service:

Registration Card. The Registration Card provided at the back of this manual must be completed and returned to an Authorized D-Link Service Office for each D-Link product within ninety (90) days after the product is purchased and/or licensed. The addresses/telephone/fax list of the nearest Authorized D-

Link Service Office is provided in the back of this manual. FAILURE TO PROPERLY COMPLETE AND TIMELY RETURN THE REGISTRATION CARD MAY AFFECT THE WARRANTY FOR THIS PRODUCT.

Submitting A Claim. Any claim under this limited warranty must be submitted in writing before the end of the Warranty Period to an Authorized D-Link Service Office. The claim must include a written description of the Hardware defect or Software nonconformance in sufficient detail to allow D-Link to confirm the same. The original product owner must obtain a Return Material Authorization (RMA) number from the Authorized D-Link Service Office and, if requested, provide written proof of purchase of the product (such as a copy of the dated purchase invoice for the product) before the warranty service is provided. After an RMA number is issued, the defective product must be packaged securely in the original or other suitable shipping package to ensure that it will not be damaged in transit, and the RMA number must be prominently marked on the outside of the package. The packaged product shall be insured and shipped to Authorized D-Link Service Office with all shipping costs prepaid. D-Link may reject or return any product that is not packaged and shipped in strict compliance with the foregoing requirements, or for which an RMA number is not visible from the outside of the package. The product owner agrees to pay D-Link's reasonable handling and return shipping charges for any product that is not packaged and shipped in accordance with the foregoing requirements, or that is determined by D-Link not to be defective or non-conforming.

What Is Not Covered:

This limited warranty provided by D-Link does not cover:

Products that have been subjected to abuse, accident, alteration, modification, tampering, negligence, misuse, faulty installation, lack of reasonable care, repair or service in any way that is not contemplated in the documentation for the product, or if the model or serial number has been altered, tampered with, defaced or removed;

Initial installation, installation and removal of the product for repair, and shipping costs;

Operational adjustments covered in the operating manual for the product, and normal maintenance;

Damage that occurs in shipment, due to act of God, failures due to power surge, and cosmetic damage; and

Any hardware, software, firmware or other products or services provided by anyone other than D-Link.

Disclaimer of Other Warranties: EXCEPT FOR THE LIMITED WARRANTY SPECIFIED HEREIN, THE PRODUCT IS PROVIDED "AS-IS" WITHOUT ANY WARRANTY OF ANY KIND INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT. IF ANY IMPLIED WARRANTY CANNOT BE DISCLAIMED IN ANY TERRITORY WHERE A PRODUCT IS SOLD, THE DURATION OF SUCH IMPLIED WARRANTY SHALL BE LIMITED TO NINETY (90) DAYS. EXCEPT AS EXPRESSLY COVERED UNDER THE LIMITED WARRANTY PROVIDED HEREIN, THE ENTIRE RISK AS TO THE QUALITY, SELECTION AND PERFORMANCE OF THE PRODUCT IS WITH THE PURCHASER OF THE PRODUCT.

Limitation of Liability: TO THE MAXIMUM EXTENT PERMITTED BY LAW, D-LINK IS NOT LIABLE UNDER ANY CONTRACT, NEGLIGENCE, STRICT LIABILITY OR OTHER LEGAL OR EQUITABLE THEORY FOR ANY LOSS OF USE OF THE PRODUCT, INCONVENIENCE OR DAMAGES OF ANY CHARACTER, WHETHER DIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL (INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF

GOODWILL, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, LOSS OF INFORMATION OR DATA CONTAINED IN, STORED ON, OR INTEGRATED WITH ANY PRODUCT RETURNED TO D-LINK FOR WARRANTY SERVICE) RESULTING FROM THE USE OF THE PRODUCT, RELATING TO WARRANTY SERVICE, OR ARISING OUT OF ANY BREACH OF THIS LIMITED WARRANTY, EVEN IF D-LINK HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE SOLE REMEDY FOR A BREACH OF THE FOREGOING LIMITED WARRANTY IS REPAIR, REPLACEMENT OR REFUND OF THE DEFECTIVE OR NON-CONFORMING PRODUCT.

GOVERNING LAW: This Limited Warranty shall be governed by the laws of the state of Singapore.

Trademarks
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Copyright Statement
No part of this publication may be reproduced in any form or by any means or used to make any derivative such as translation, transformation, or adaptation without permission from D-Link Corporation/ D-Link International Ptd Ltd.

FCC Warning

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Tech Support

Technical Support

You can find software updates and user documentation on the D-Link website.

D-Link provides free technical support for customers within the United States and within Canada for the duration of the service period, and warranty confirmation service, during the warranty period on this product. U.S. and Canadian customers can contact D-Link technical support through our website, or by phone.

Tech Support for customers within the United States:

D-Link Technical Support over the Telephone:

USA - 877-DLINK-55 (877-354-6555)

D-Link Technical Support over the Internet:

http://support.dlink.com

Tech Support for customers within Canada:

D-Link Technical Support over the Telephone:

877-354-6560

D-Link Technical Support over the Internet:

http://support.dlink.com

D-Link®
Building Networks for People

Technical Support

United Kingdom (Mon-Fri)

Home Wireless/Broadband 0871 873 3000 (9.00am–06.00pm, Sat 10.00am-02.00pm)

Managed, Smart, & Wireless Switches, or Firewalls 0871 873 0909 (09.00am – 05.30pm)

(BT 10ppm, other carriers may vary.)

Ireland (Mon-Fri)

All Products 1890 886 899 (09.00am-06.00pm, Sat 10.00am-02.00pm)

€ 0.05ppm peak, €0.045ppm off peak Times

Internet

http://www.dlink.co.uk

ftp://ftp.dlink.co.uk

Technische Unterstützung

Deutschland:	Web:	http://www.dlink.de
	E-Mail:	support@dlink.de
	Telefon:	+49(0)1805 2787 0,14 € pro Minute
	Zeiten:	Mo. –Fr. 09:00 – 17:30 Uhr
Österreich:	Web:	http://www.dlink.at
	E-Mail:	support@dlink.at
	Telefon:	+43(0)820 480084 0,116 € pro Minute
	Zeiten:	Mo. –Fr. 09:00 – 17:30 Uhr
Schweiz:	Web:	http://www.dlink.ch
	E-Mail:	support@dlink.ch
	Telefon:	+41(0)848 331100 0,08 CHF pro Minute
	Zeiten:	Mo. –Fr. 09:00 – 17:30 Uhr

* Gebühren aus Mobilnetzen und von anderen Providern können abweichen.

* Gebühren aus Mobilnetzen und von anderen Providern können abweichen.

Assistance technique

Assistance technique D-Link par téléphone : 0 820 0803 03
0,12 €/min la minute : Lundi – Vendredi de 9h à 13h et de 14h à 19h
Samedi 9h à 13h et de 14h à 16h
Assistance technique D-Link sur internet :
http://www.dlink.fr

Asistencia Técnica

Asistencia Técnica Telefónica de D-Link: +34 902 30 45 45
0,067 €/min
De Lunes a Viernes de 9:00 a 14:00 y de 15:00 a 18:00
http://www.dlink.es

Supporto tecnico

Supporto Tecnico dal lunedì al venerdì dalle ore 9.00 alle ore 19.00 con orario continuato
Telefono: 199400057
http://www.dlink.it/support

Technical Support

Tech Support for customers within the Netherlands:
0900 501 2007 / www.dlink.nl / €0.15ppm anytime.
Tech Support for customers within Belgium:
070 66 06 40 / www.dlink.be / €0.175ppm peak, €0.0875ppm off peak
Tech Support for customers within Luxemburg:
+32 70 66 06 40 / www.dlink.be

Pomoc techniczna

Telefoniczna pomoc techniczna firmy D-Link: 0 801 022 021
Pomoc techniczna firmy D-Link świadczona przez Internet:
URL: http://www.dlink.pl
e-mail: serwis@dlink.pl

Technická podpora

Web: http://www.dlink.cz/suppport/
E-mail: support@dlink.cz
Telefon: 225 281 553
Telefonická podpora je v provozu: PO- PÁ od 09.00 do 17.00
Land Line 1,78 CZK/min - Mobile 5.40 CZK/min

Technikai Támogatás

Tel. : 06 1 461-3001
Fax : 06 1 461-3004
Land Line 14,99 HUG/min - Mobile 49.99,HUF/min
email : support@dlink.hu
URL : http://www.dlink.hu

Teknisk Support

D-Link Teknisk telefon Support: 820 00 755

(Hverdager 08:00-20:00)

D-Link Teknisk Support over Internett: http://www.dlink.no

Teknisk Support

D-Link teknisk support over telefonen: Tlf. 7026 9040
Åbningstider: kl. 08:00 – 20:00
D-Link teknisk support på Internettet: http://www.dlink.dk

Teknistä tukea asiakkaille Suomessa:

Arkisin klo. 9 - 21
numerosta : **06001 5557**
Internetin kautta : http://www.dlink.fi

Teknisk Support

D-Link Teknisk Support via telefon: 0900-100 77 00
Vardagar 08.00-20.00
D-Link Teknisk Support via Internet: http://www.dlink.se

Assistência Técnica

Assistência Técnica da D-Link na Internet:
http://www.dlink.pt
e-mail: soporte@dlink.es

Τεχνική Υποστήριξη

D-Link Hellas Support Center
Κεφαλληνίας 64, 11251 Αθήνα,
Τηλ: 210 86 11 114 (Δευτέρα- Παρασκευή 09:00-17:00)
Φαξ: 210 8611114
http://www.dlink.gr/support

Tehnička podrška

Hvala vam na odabiru D-Link proizvoda. Za dodatne informacije, podršku i upute za korištenje uređaja, molimo vas da posjetite D-Link internetsku stranicu na www.dlink.eu

www.dlink.biz/hr

Tehnična podpora

Zahvaljujemo se vam, ker ste izbrali D-Link proizvod. Za vse nadaljnje informacije, podporo ter navodila za uporabo prosimo obiščite D-Link - ovo spletno stran www.dlink.eu

www.dlink.biz/sl

Suport tehnica

Vă mulțumim pentru alegerea produselor D-Link. Pentru mai multe informații, suport şi manuale ale produselor vă rugăm să vizitați site-ul D-Link www.dlink.eu

www.dlink.ro

Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers in

Australia:

Tel: 1300-766-868

24/7(24Hrs, 7days a week) technical support

http://www.dlink.com.au

e-mail: support@dlink.com.au

India:

Tel: 1800-222-002

9.00 AM to 9.00 PM. All days

http://www.dlink.co.in/support/productsupport.aspx

Indonesia, Malaysia, Singapore and Thailand:

Tel: +62-21-5731610 (Indonesia)

Tel: 1800-882-880 (Malaysia)

Tel: +65 6501 4200 (Singapore)

Tel: +66-2-719-8978/9 (Thailand)

24/7, for English Support Only

http://www.dlink.com.sg/support/

e-mail: support@dlink.com.sg

Korea:

Tel: +82-2-2028-1815

Monday to Friday 9:00am to 6:00pm

http://www.d-link.co.kr

e-mail: arthur@d-link.co.kr

New Zealand:

Tel: 0800-900-900

24/7(24Hrs, 7days a week) technical support

http://www.dlink.co.nz

e-mail: support@dlink.co.nz

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Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers in

Egypt:

Tel: +202-2919035 or +202-2919047

Sunday to Thursday 9:00am to 5:00pm

http://support.dlink-me.com

Email: support.eg@dlink-me.com

Iran:

Te: +98-21-88880918,19

Saturday to Thursday 9:00am to 5:00pm

http://support.dlink-me.com

Email : support.ir@dlink-me.com & support@dlink.ir

Israel:

Magshimim 20 St., Matalon center,

Petach Tikva, Israel 49348

Consumer support line: 03-9212886

Business support line: 03-9212608

Pakistan:

Tel: +92-21-4548158 or +92-21-4548310

Monday to Friday 10:00am to 6:00pm

http://support.dlink-me.com

E-mail: zkashif@dlink-me.com

South Africa and Sub Sahara Region:

Tel: +27-12-665-2165

08600 DLINK (for South Africa only)

Monday to Friday 8:30am to 9:00pm South Africa Time

http://www.d-link.co.za

Turkey:

Tel: +90-212-2895659

Monday to Friday 9:00am to 6:00pm

http://www.dlink.com.tr

e-mail: turkiye@dlink-me.com

e-mail: support@d-link.co.za

U.A.E and North Africa:

Tel: +971-4-4278127 (U.A.E)

Sunday to Thursday 9.00AM to 6.00PM GMT+4

Web: http://www.dlink-me.com

E-mail: support.me@dlink-me.com

Saudi ARABIA (KSA):

Telephone : +966 01 217 0008

Facsimile : +966 01 217 0009

e-mail: Support.sa@dlink-me.com

Saturday to Wednesday 9.30AM to 6.30PM

Thursdays 9.30AM to 2.00 PM

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Техническая поддержка

Обновления программного обеспечения и документация доступны на Интернет-сайте D-Link.

D-Link предоставляет бесплатную поддержку для клиентов в течение гарантийного срока.

Клиенты могут обратиться в группу технической поддержки D-Link по телефону или через Интернет.

Техническая поддержка D-Link:
+7(495) 744-00-99

Техническая поддержка через Интернет
http://www.dlink.ru
e-mail: support@dlink.ru

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SOPORTE TÉCNICO

Usted puede encontrar actualizaciones de softwares o firmwares y documentación para usuarios a través de nuestro sitio www.dlinkla.com

SOPORTE TÉCNICO PARA USUARIOS EN LATINO AMERICA

Soporte técnico a través de los siguientes teléfonos de D-Link

PAIS	NUMERO	HORARIO
Argentina	0800 - 12235465	Lunes a Viernes 08:00am a 21:00pm
Chile	800 - 835465 ó (02) 5941520	Lunes a Viernes 08:00am a 21:00pm
Colombia	01800 - 9525465	Lunes a Viernes 06:00am a 19:00pm
Costa Rica	0800 - 0521478	Lunes a Viernes 05:00am a 18:00pm
Ecuador	1800 - 035465	Lunes a Viernes 06:00am a 19:00pm
El Salvador	800 - 6335	Lunes a Viernes 05:00am a 18:00pm
Guatemala	1800 - 8350255	Lunes a Viernes 05:00am a 18:00pm
México	01800 - 1233201	Lunes a Viernes 06:00am a 19:00pm
Panamá	011 008000525465	Lunes a Viernes 05:00am a 18:00pm
Perú	0800 - 00968	Lunes a Viernes 06:00am a 19:00pm
República Dominicana	18887515478	Lunes a Viernes 05:00am a 18:00pm
Venezuela	0800 - 1005767	Lunes a Viernes 06:30am a 19:30pm

Soporte Técnico de D-Link a través de Internet

www.dlinkla.com

e-mail: soporte@dlinkla.com & consultas@dlinkla.com

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Suporte Técnico

Você pode encontrar atualizações de software e documentação de usuário no site da D-Link Brasil.

A D-Link fornece suporte técnico gratuito para clientes no Brasil durante o período de vigência da garantia deste produto.

Suporte Técnico para clientes no Brasil:

Telefone

São Paulo +11-2185-9301

Segunda à sexta

Das 8h30 às 18h30

Demais Regiões do Brasil 0800 70 24 104

E-mail:

e-mail: suporte@dlinkbrasil.com.br

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D-Link 友訊科技 台灣分公司
技術支援資訊

如果您還有任何本使用手冊無法協助您解決的產品相關問題，台灣地區用戶可以透過我們的網站、電子郵件或電話等方式與D-Link台灣地區技術支援工程師聯絡。

D-Link 免付費技術諮詢專線

0800-002-615

服務時間：週一至週五，早上9:00到晚上9:00

（不含周六、日及國定假日）

網　　站：http://www.dlink.com.tw

電子郵件：dssqa_service@dlink.com.tw

如果您是台灣地區以外的用戶，請參考D-Link網站全球各地分公司的聯絡資訊以取得相關支援服務。

產品保固期限、台灣區維修據點查詢，請參考以下網頁說明：

http://www.dlink.com.tw

產品維修：

使用者可直接送至全省聯強直營維修站或請洽您的原購買經銷商。

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Dukungan Teknis

Update perangkat lunak dan dokumentasi pengguna dapat diperoleh pada situs web D-Link.

Dukungan Teknis untuk pelanggan:

Dukungan Teknis D-Link melalui telepon:

Tel: +62-21-5731610

Dukungan Teknis D-Link melalui Internet:

Email : support@dlink.co.id

Website : http://support.dlink.co.id

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Technical Support

この度は弊社製品をお買い上げいただき、誠にありがとうございます。

下記弊社 Web サイトからユーザ登録及び新製品登録を
行っていただくと、ダウンロードサービスにて
サポート情報、ファームウェア、ユーザマニュアルを
ダウンロードすることができます。

ディーリンクジャパン Web サイト
URL:http://www.dlink-jp.com

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技术支持

您可以在 D-Link 的官方网站找到产品的软件升级和使用手册

办公地址：北京市东城区北三环东路 36 号 环球贸易中心 B 座 26F 02-05 室 邮编: 100013

技术支持中心电话：8008296688/ (028)66052968

技术支持中心传真：(028)85176948

维修中心地址：北京市东城区北三环东路 36 号 环球贸易中心 B 座 26F 02-05 室 邮编: 100013

维修中心电话：(010) 58257789

维修中心传真：(010) 58257790

网址：http://www.dlink.com.cn

办公时间：周一到周五，早09:00到晚18:00

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